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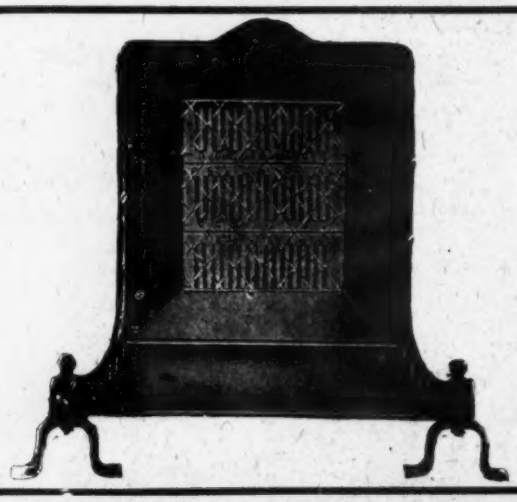

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ELECTRICAL REVIEW.

VOL. XC. FEBRUARY 24, 1922. No. 2,309.

ELECTRICAL REVIEW.

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THE F.B.I. ON COSTS OF PRODUCTION.

As readers of the ELECTRICAL REVIEW are already aware, the Federation of British Industries released to the Press, on February 10th, a Report on the "Earnings of Labour and Costs of Production," drawn up by the Production Cost Sub-Committee of its Trade Depression Committee.

The Sub-Committee has reported upon the state of things existing before the war, the changes brought about since the outbreak of war, the post-war boom, the slump, and the causes of the present depression. It has, further, gone into the relations between wages and production costs, the cost of living, and profits, and has dealt with several economic fallacies which are periodically refuted, only to raise their heads again in some other quarter.

The Report does not appear to agree that the standard of living of the working classes before the war was unduly low, and draws comparisons between the state of things then and that which obtained in the early years of the nineteenth century. Although we hear much from older folk about "the good old times," it is certainly true that the condition of the workers at about the time of the Napoleonic wars was deplorable. Long hours, low wages, child labour, the employment of women in unsuitable occupations, wretched sanitary conditions—even the most scanty acquaintance with the advances made in the past hundred years must make one thankful that one did not live in those days. These advances were due, in the main, to the development of the use of machinery in industry, rendered possible by the invention of the steam engine. This, together with the development of food production consequent upon the opening up of new countries, brought about a state of plenty, and consequent cheapness, which would have seemed incredible to our ancestors of a hundred years ago. It is at once seen from this sequence of events that the improvement in conditions was directly due to, and arose out of, low production costs, and plenty of everything. Great Britain was enabled to export manufactured articles, to become a wealthy nation, and to invest great sums abroad.

When the war broke out and our sources of raw materials were cut off, and our labour was all taken up in the production of destructive apparatus, it was no longer possible to pay for our imports with manufactured goods, and our invisible exports, the services rendered to the world by our merchant shipping, were interfered with. It therefore became necessary for the country's foreign investments to be disposed of, in order to pay our way. This impoverished the nation, just as those who live bounteously upon their seed corn or seed potatoes impoverish themselves, and do away with their future earning capacity.

If this is what happened to a successful belligerent, and to a country which was not invaded, it is clear that countries like France and Belgium, which were invaded, and also the nations which were on the losing side, must be even worse off. Hence the export market, as all trades know, is practically non-existent.

In this period of scarcity of everything except paper money, the opportunity was taken to shorten the working week, and to revive and strengthen trade union regulations having for their object the restriction of output. That is to say, regardless of the lesson of the previous century, it was sought to maintain a falsely prosperous condition of things by making everything as dear and as scarce as possible, instead of as cheap and as plentiful as possible.

The Report ascribes the depression to three great underlying causes: "(1) lack of balance in the world's markets, with consequent general under-production; (2) unsound government finance resulting in chaotic exchanges; and (3) in certain countries the low ratio of output to wages. The burden of all of these is the same—high production costs, leading to scarcity and dearness. The Federation, having adopted the Report, may be taken as approving the remedies suggested. On the first point more can be done by Governments in a negative way than otherwise; "for example, by modifying the reparation payments in such a way as to make the least possible disturbance of the world's trade and by removing hampering restrictions upon commerce." As to this, what else has the Electrical Review been preaching in season and out of season ever since the Versailles chaos became public knowledge? This eminently sane utterance, coming with the authority of the F.B.I., should have its influence upon the public opinion of Great Britain and her Allies, and upon the Governments of those nations. The policy of a certain past president of the Federation, who believed it would be advantageous to accept payment of the indemnity in German electrical manufactures, is personal to himself, and finds no echo in the Federation's official pronouncements.

On the second point, the strictest national economy is enjoined, and we may here observe that the Press campaign in favour of personal extravagance is unwholesome. Now, as during the war, personal economy is necessary as a habit of mind.

The Report goes on: "The third problem is less world-wide, but, so far as our own position is concerned, its solution is a necessary preliminary to the restoration of normal trade conditions. This involves the raising of output per head in the United Kingdom to a level at least as satisfactory as that attained on the Continent of Europe, and can only be secured by better concentration on the part of workpeople and improved organisation on the part of their employers." In other words, all must still strive after efficiency. An increase of output per man-hour of labour applied cheapens manufacturing costs immediately, and it would be palpably absurd to pretend that the workers are doing their best to-day. How often does one see a gang of a dozen men, with two or three working and the rest standing looking on! Of course, Army methods did nothing to improve the natural aversion of the British workman to personal effort. The custom of sending a platoon to do what half a dozen men could have done more effectively naturally encouraged the practice of standing about instead of getting at it. The workman himself has lost a large amount of personal efficiency through the war, and the restrictive methods of the unions, upon which we have commented frequently, is a very effective curb upon a too great exuberance in the individual.

But the sting of the Report is in its tail, for "it may be necessary to go further (an increased output per head), and for the workers to be prepared to accept a money wage which may, until business revives, give them a lower standard of living than that which prevailed before the trade depression set in, *or even than their pre-war standard.*" The italics are ours.

Now, frankly, we are not convinced of the necessity for this. There is something to be said for a variation in money wages which shall follow the cost of living, though in saying this we must not be taken as accepting the preposterous index figure, which indicates a fall of four points between December 31st and the middle of February, when almost every commodity has slightly risen in price. The standard of living of the American worker is popularly supposed, not to say vaunted, to be better than that of the British worker. His efficiency and output are stated to be higher. His money wage is certainly higher, and here we touch the crux of the whole matter. The wicked policy of the cutting of piece rates, of fixing an upper limit to remuneration, so long followed, preached, and defended by the administrators of our industries, and only reluctantly abandoned under extreme pressure (if indeed it has been entirely abandoned even now) is responsible for the distrust felt by the working class towards the employer class. Pay the worker for what he turns out, even if he earns twenty pounds a week, and he will be at least more inclined to work than if he feels he can never get more than three or four or five pounds. Such a policy directly feeds the fallacy of the "lump of labour," to which the Report alludes. The amount of work to be done is *not* limited, and the reward to be gained is unlimited too. But if effort be limited, reward will be limited, and if reward be limited, effort will be limited, thus giving us a vicious circle from which escape is only possible by enthusiasm for work on the part of all. It is the workers' duty to work; it is the employers' duty to find the work. These duties carried out, as we have said, with enthusiasm, the rest follows naturally.

Christianity and Industry.

One frequently encounters the opinion that in character the great bulk of the population of these islands exhibits retrograde tendencies, that moral standards are low and moral susceptibilities weak, whilst our attitude toward spiritual concerns is one of deplorable indifference. We suppose it always was so. It may be very misleading, however, in any age to deduce large and important conclusions from surface tendencies, and we certainly think it is unsafe to dogmatise with regard to the present state of the human mind and spirit either at home or abroad. We are temperamentally inclined to take encouragement from the good that is in our fellows and in our organisations, and to believe that part at least of what some regard as definite and permanent retrograde characteristics are but passing developments which are not to be wondered at when shackles of past days are breaking and progress is being made toward a freer, broader, and better life. It is not the British temperament to wear one's religious belief upon the sleeve; only in patches are these islands particularly emotional; but because they are mainly unemotional or undemonstrative it need not follow that they are irreligious or un-Christian, possibly quite the reverse may be the case. As a matter of fact, spiritual influences are always quietly at work within our race, whether organised religion as such appears to be advancing or receding, but the terms religion and Christianity are far from being synonymous, and the latter is respected and revered, and we believe practised, by many whom the former term leaves cold and uninterested. We have innumerable organisations for the spread of religious teaching, and their influence on our common life is inestimable, as it affects the habits and characters and modes of thought of individuals in business and industry as well as in private and social relations. Herein, in our opinion, lies the strength of spiritual forces making for righteousness within the nation. If this is so, then, is there need for a "National movement towards a Christian Order of Industry and Commerce" such as is now announced, with the aim "to rally men of goodwill in the administration of industry, commerce, and the professions, for the application of Christian principles to industrial, commercial, and professional life"? We have received a copy of its "prospectus" with an explanatory statement, and an appeal for members and funds. It is held that the tremendous importance of the economic issues of to-day calls especially for a definitely Christian movement in

business; the promoters include many well-known business and professional men, and they seek to find in the Christian ethic, and in the principles of Christianity as generally understood, a practical guide and solution for the industrial unrest and disorder of our time. The term "Christian principles" is used as referring to the ethical teaching of Christianity and not in a specially theological and ecclesiastical sense—a precaution in which the promoters have been wise. Though it is felt that "the Christian business man as such is still largely inarticulate," it must not be imagined that he is necessarily less influential as an individual Christian. Business men do not throw off their Christianity when they commence commercial and industrial operations on a Monday morning and resume the mantle on Saturday evening. Hundreds of thousands of them carry their principles into their daily vocation. We do not incline to the view that while to the rest of the world we profess to be a Christian nation, we are altogether unchristian in our business, industry, and professions. So far as we can see, the present "enterprise" seeks in the realm of economics to discover the golden lines of equity, justice, and right, and to secure their acceptance as the basis of all future relationships. As this is in agreement with so much that has been written in these pages and has been written by many other authorities in book and pamphlet form, and has been said in so many public speeches advocating co-operation between all classes in improving the relations between employers and employed, we heartily give our support to the movement. Whether the good sense of the nation is already leading us in that direction more surely than can this additional organisation one cannot say, but we have a sort of feeling than it is so doing. Would not the main usefulness of the new Order lie in the spread of its principles among the uninformed rather than in searching for a new "basis"? However, the offices of the National Movement towards a Christian Order of Industry and Commerce are at 24, Great Russell Street, London, W.C.1, and we recommend all our readers who are anxious to help in the remoulding of industrial and commercial life to write for a "prospectus," which will give them a great deal of very useful matter which we regret we have not room to publish.

Mathematical Misconceptions.

In the course of his reminiscences at the I.E.E. on Wednesday last, Col. Crompton referred to the belief which used to prevail in the '70's, that the internal resistance of a dynamo should not be less than half the resistance of the external circuit. This may seem startling to the present generation. It can easily be shown that if the e.m.f. is constant, the *output* of a battery in watts will be a maximum when the external resistance is equal to the internal resistance; the electrical efficiency will then obviously be 50 per cent. If the external resistance then be diminished, the efficiency will fall, as well as the output, although the current will increase, and when the external resistance is zero, the efficiency and output will be zero—assuming, of course, that the only e.m.f. in the circuit is that of the battery. But if the external resistance be increased the efficiency will increase while the output falls off, until as the external resistance approaches infinity the efficiency approaches infinity and the output approaches zero.

In the early days, when primary batteries were the customary source of electrical energy, it was important to secure as large an output as possible, and this may have been the reason why so much emphasis was laid on the condition of equal internal and external resistance; unfortunately, somewhat confused ideas prevailed when the dynamo was in course of evolution, with the result that electrical engineers went out of their way to build armatures of high resistance when they should have worked in exactly the opposite direction.

In this connection we may draw the attention of our younger readers, who have been taught to "differentiate and equate to zero," to the fact that while this process indicates the condition for a maximum or minimum, it does not give any guidance with regard to the shape of the curve in the neighbourhood of the point thus localised. Granted that a maximum value exists—it is important to know whether a wide departure from the point at which it occurs produces much change in the dependent variable. Often it will be found that over a wide range no material change takes place, and, quoting the advice of the late Professor Perry, we would say: *Plot the curve.* Then one can see at a glance what weight should be attributed to the theoretical "maximum."

False Economy.

The natural sentiment in favour of economy in Government administration is, we think, leading the public—or at any rate a section of the Press—to take an unsound view regarding one portion of the Geddes Report. We refer to that which deals with the Department of Overseas Trade.

It is impossible to regard the Committee as serious in its contention that to cut about £100,000 from the cost of the Department of Overseas Trade would be a real economy in a community whose very life depends upon its overseas business. In our view, the Committee is attempting to reverse the policy adopted at the insistent call of commercial men, and subsequently approved by far more representative Committees than Sir Eric Geddes and his co-executioners. The Committee prefaces its recommendations with a statement to the effect that it is no part of the duty of a Government department to give specific assistance to the trades. Surely further consideration is needed before the country agrees to reduce to impotence a Department which has its parallel in almost every other country interested in export trade. As was pointed out recently in these columns, the United States has placed Mr. Hoover—one of the most outstanding administrators of these times—at the head of its Department of Foreign Commerce, is greatly increasing its expenditure on the service, and is modelling the organisation on that of the British Department of Overseas Trade. Not only are the recommendations of the Geddes Committee inconsistent with those of the Cave and Faringdon Committees, but inconsistency is also revealed in its own proposals. Whilst it favours the retention of the Commercial Secretaries in foreign countries, it considers that the Trade Commissioners in the Dominions should be reduced to two. Yet we are convinced that the latter have done their work well. Moreover, from the point of view of furthering British commercial interests, it is as important to station official representatives in Dominion markets as in any other. The Committee appears annoyed because the Department was thanked by a correspondent for obtaining a reduction in the freight rate on Jaffa oranges. Though such annoyance is, perhaps, excusable on the part of men largely concerned in shipping, we think that electrical manufacturers will recognise with gratitude the assistance given by the Trade Commissioners in Australia and in New Zealand in certain cognate matters, viz., the tariff treatment of electrical goods.

Another matter which claims attention in this connection is the future of the Electricity Commission. The Geddes Committee recommends that the Ministry of Transport shall cease to exist as a separate Ministry, and that its functions shall be transferred to the Board of Trade, so that the Electricity Commissioners, if that course is followed, will come under the President of the Board. It will be remembered that the Act of 1919 was worded throughout on that very basis, with the exception that in Section 39 provision was made for the transference of the powers and duties of the Board of Trade to the Ministry of Transport. We strongly objected to the transfer, and we see no reason why it should not be reversed. That the Commission will be maintained in force, and strengthened with additional statutory powers at an early date, is assured by recent official utterances.

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THE CHLORIDE ELECTRICAL STORAGE CO.'S ORGANISATION.

Hitherto the sale of a manufactured article has generally meant the termination of the relationship, if any really existed, between the manufacturer and the purchaser. However, the public is becoming impressed with the fact that the sale of an article should not only carry with it a lasting assurance of satisfaction, but that its manufacurer should endeavour to co-operate with the purchaser, either directly, or through his agent, in ensuring the usefulness of the article.

That co-operation is nothing more or less than what is now referred to as "service," and a more striking illustration of service to the consumer than that relating to the "Exide" automobile starting and lighting battery as rendered by the Chloride Electrical Storage Co., Ltd., it would be difficult to find.

The service originates at the factory, a visit to which we described about two years ago,* and is world wide; there are over 200 service stations in the British Isles, in addition to depôts at many of the principal cities and towns in the following countries: Australia, Austria, Belgium, Burma, Central and South America, Denmark, France, Holland, India, New Zealand, Norway, the Philippine Islands, Siam, South Africa, Spain, the Straits Settlements, Sweden, and the West Indies, whilst in Canada and the U.S.A. "Exide" service stations have been established under the control of the allied company, the Electrical Storage Battery Co., of Philadelphia. They are not merely garages or repair shops, but are well equipped for the sale, care, charging, and repair of accumulators under competent supervision, and motor-car owners who cultivate the habit of looking out for the sign illustrated in fig. 1 can be sure of obtaining the same service wherever they may be. The service is rendered without obligating the battery user in any way and, be it noted, it makes no difference what type of battery the car owner happens to be using, all makes can be cared for. If it is necessary to leave a battery at the depôt for repairs, the owner is furnished with another which he can use until the work is completed.

The latest Exide battery depôt and showrooms to be opened are those in Shaftesbury Avenue, London; a shop for the sale of accumulators on the lines outlined above is somewhat of a novelty, but the organisation of the service has reached such a point that successful results are bound to follow. There is no intention to supplant the trade or service agents, but rather to support them. All American motor cars are equipped with electric starters and lighting nowadays, and there will be few English cars this season that will not be similarly provided, and Continental manufacturers are following suit. Therefore, battery service has to be as universal as their use, and emphasis should be laid upon the fact that the Exide battery is made only in two places—at Clifton Junction, near Manchester, and at Philadelphia, in the U.S.A.; but the two makes are precisely the same in every respect and are interchangeable.

*Elec. Rev., February 27th, 1920; p. 259.

Battery service is in a different category to any other engineering service, because an accumulator is not merely a mechanical, or electrical, nor yet a chemical contrivance, but a complication of the three, and the qualifications required by an agent in order that he may give efficient service are rather special. It will, therefore, be appreciated that the organisation of a service of this description has taken years—the work has been slow, but it has now reached the stage where reliance can be placed upon it.

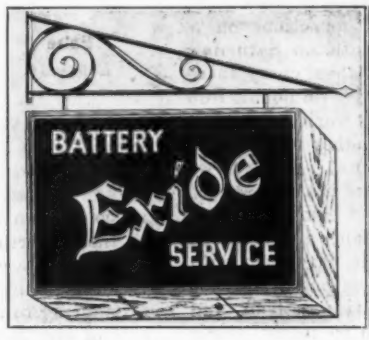


Fig. 1.—The Universal Depot Sign.

Fig. 2.—A 3-cell, 6-volt, Motor-car Battery.

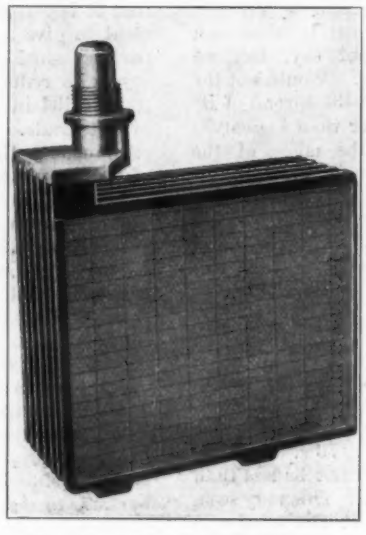


Fig. 3.—A Set of Battery Plates.

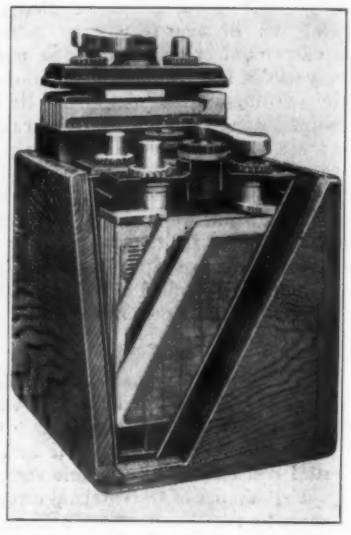


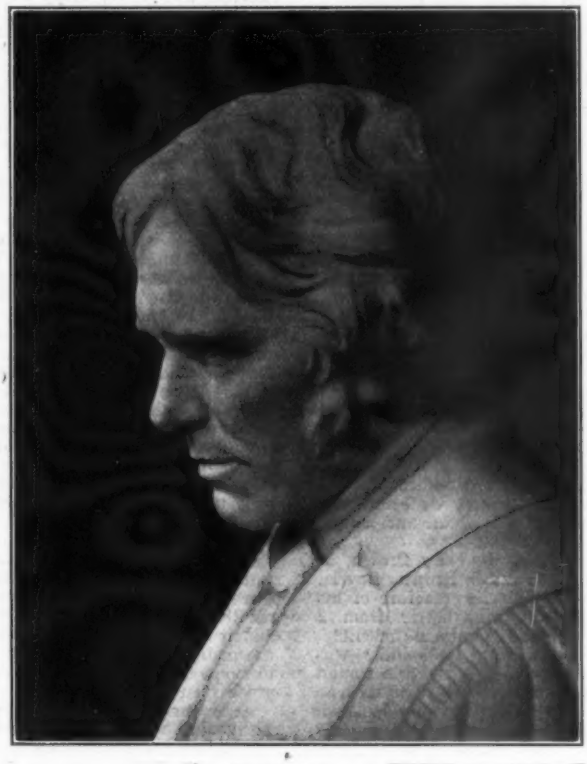
Fig. 4.—An Exide Battery.

Standardising Dry Batteries in the U.S.A.—With the purpose of standardising, so far as possible, specifications for and the sizes of commercial dry cells, the American Bureau of Standards recently called a conference, at which the majority of the manufacturers of such batteries, together with a large number of users, were represented. The work was not new to the Bureau, as considerable progress had been made during the war in co-operation with the War Industries Board. At this conference seventeen sizes of the larger dry cells were considered and seven were recommended as standard, thirty different sizes and kinds of flashlight batteries were considered and eight adopted as standard sizes, two sizes of batteries were also recommended as standards for use with wireless outfits. It is expected that the elimination of many sizes for which there is but little demand will result in a considerable saving in the cost of manufacture. When it is considered that on an average 150,000,000 dry cells are sold each year, this is a matter of considerable consequence. Specifications were also adopted for the performance of dry cells which, it is believed, will assist in the securing of a more uniform product.—*T. and T. Age.*

THE INSTITUTION OF ELECTRICAL ENGINEERS.

JUBILEE CONFERENCE, 1922.

[Dr. John Ambrose Fleming, F.R.S., M.I.E.E., who delivered the lecture on "Michael Faraday and the Foundations of Electrical Engineering," in connection with the I.E.E. commemorations, on Tuesday afternoon and again on Wednesday evening, was born at Lancaster on November 29th, 1849, and is therefore just over 72 years old. He was educated at University College School, University College, London, The Royal College of Science and at St. John's College, Cambridge. He graduated B.Sc. in 1870 and D.Sc. in 1879 in the University of London, and was a Science Exhibitioner, Foundation Scholar, Prizeman and Fellow of St. John's College, Cambridge. He worked in the Cavendish laboratory from 1877 to 1879 under Professor Clerk Maxwell, and carried out some special work there on the standards of electrical resistance. He was the first Professor of Mathematics and Physics at University College, Nottingham, in 1881-2, and in 1882 he was appointed Scientific Adviser to the Edison Electric Light Co., of London. In 1885 he was elected as the first Professor of Electrical Engineering at University College, London, a position which he has held for thirty-seven years with distinguished ability. He was elected a Fellow of the Royal Society in 1893, and received the Hughes Gold and Silver Medals in 1910 for his scientific work. Prof. Fleming has been a member of the Institution of Electrical Engineers for 40 years, and has twice been awarded the Institution Premium for papers read before it. In 1921, he was awarded the highest distinction in the power of the Royal Society of Arts, viz., the Albert Medal, especially for his inventions originating the thermionic valve. He is widely known as a lecturer, and has lectured at the Royal Institution and Royal Society of Arts probably more often than anyone else. He recently delivered the fifth "Trueman Wood" Lecture before the latter Society on "The Coming of Age of Long-Distance Wireless Telegraphy." He has acted as Scientific Adviser to numerous companies and corporations, and his recently published book "Fifty Years of Electricity, the Memories of an Electrical Engineer," records the progress of applied electricity in the last half century, with which he has been closely associated.]



Michael Faraday.
From Foley's Statue at the Royal Institution; as adopted for the Seal of the I.E.E.

The meetings were inaugurated without ceremony at 3 p.m. on February 21st. Mr. A. A. Campbell Swinton, vice-president, presided in the absence of the President, due to sudden illness; the meeting passed a vote of commiseration with Mr. J. S. Highfield. The lecture was illustrated by many original lantern slides, and by numerous experiments repeating some of Faraday's memorable discoveries in electricity and magnetism.

The managers of the Royal Institution also kindly permitted Dr. Fleming to exhibit some of Faraday's original apparatus with which these great discoveries were made, such as the iron ring coil used in the discovery of the induction of electric currents, the Leyden jars used to determine specific inductive capacity, and one of Faraday's magnets used in his experiments on magnetism and diamagnetism. Also the Science Museum at South Kensington lent many models and samples of early magneto-electric and dynamo machines, such as those of Pacinotti, Gramme, Siemens, Wilde, Varley, and others; and one of the first made Parsons steam turbines, direct coupled to a high-speed dynamo. Documents and manuscripts of historical value were also on view.

Throwing on the lantern screen a photograph of Foley's fine statue of Michael Faraday, which stands in the entrance hall of the Royal Institution, Dr. Fleming reminded his audience that Faraday became connected with that Institution as the assistant of Sir Humphrey Davy in 1813, when he was 22 years old. His earliest research work, following Davy's leading, was chemical in character. When in 1820 Oersted made the discovery of the magnetic field round a wire conveying an electric current, Faraday solved in a very neat manner the experimental problem of making a magnet rotate continuously round a current-carrying wire, and so gave us the first electric motor. He was thereby stimulated to endeavour to produce a current by the action of a magnet. After failing in his first efforts in 1824, 1825, and 1828, he at last succeeded on August 31st, 1831, in his epoch-making discovery. He wound on an iron ring two tape-covered copper wires, and found (1) that the passage of an electric current through one wire created a brief current in the other wire at the instant of starting or stopping the primary current. Faraday followed the clue so given, and in a series of experiments made in 10 days during the ensuing three months, he discovered (2) that when a permanent magnet is approached to or withdrawn from a helix of wire so that the lines of magnetic force "cut" the convolutions of the coil, it creates in it an electric current, and (3) that when a copper disk is rotated between the poles of a permanent magnet radial electric currents are set flowing in the disk, and can be drawn off by proper contacts. These three great discoveries developed in course of time in the hands of numerous inventors into the induction coil and the magneto-electric machine, and later on into the transformer, alternator, and dynamo. Dr. Fleming showed all these facts experimentally to his audience, and also Faraday's experiment of obtaining an electric spark from a magnet and a coil of wire. Every taxicab, motor-bus, and aeroplane has its petrol engine operated by a method of ignition which is only an improved form of Faraday's spark experiment. Dr. Fleming then explained and showed experimentally some of Faraday's discoveries in connection with electrostatics, especially that of the specific inductive capacity of insulators, which, however, had been anticipated 66 years previously by Henry Cavendish, but not published. Following this, attention was directed to Faraday's great investigation in connection with electro-chemistry, and especially his two laws of electrolysis (1) that when a current flows through an electrolytic cell the mass of the ions deposited on the electrodes is proportional to the quantity of electricity which has passed, and (2) that when a number of electrolytic cells are joined in series the masses of ions deposited in each are proportional to their chemical equivalents. Von Helmholtz pointed out in 1881 that these laws of Faraday proved that electricity was atomic in structure. An atom of electricity is now called an electron. Faraday's laws lie at the base of all electrochemical industries, and our unit of electric current, the ampere, is defined by the mass of silver it liberates per second in a nitrate of silver voltammeter. With reference to Faraday's electro-optic and magnetic work the audience was shown the great experiment which Faraday called the "magnetisation of a ray of light." A ray of plane polarised light was transmitted through a bar of Faraday's heavy glass, a boro-silicate of lead, which was placed between the poles of a powerful electromagnet. On exciting the magnet, it was seen that the plane of polarisation was rotated. Both Kelvin and Maxwell considered that this discovery of Faraday proved that some kind of rotation was taking place along lines of magnetic force. Some of Faraday's leading investigations on magnetism were next described, a view of his large electromagnet being shown on the screen.

His discoveries of diamagnetism and of the varying conductivity of substances for magnetic flux, were described. Dr. Fleming then alluded to Faraday's views on lines of electric and magnetic force, and showed how the translation by Clerk Maxwell of those views into mathematical language led Maxwell ultimately to enunciate his celebrated theory of the electromagnetic nature of light, and thus paved the way for the discovery of electromagnetic waves and the invention of wireless telegraphy.

Faraday's opinions and researches on a possible connection between gravitation and electricity were then mentioned, and it was pointed out that Einstein's theory also had predicted a connection of this kind, which was confirmed at the total solar eclipse of May 29th, 1919, where it was found that a ray of light, which was an electromagnetic wave, was deflected slightly by the mass of the sun. The lecture concluded with a eulogy of the character of Faraday as a man as well as an investigator.

Referring to the research work of the Royal Institution, Dr. Fleming said: "That Institution is without rival in the world for the enormous value of the scientific discoveries which have issued from its laboratories and the ridiculously small cost at which these results have been attained. Sir James Dewar stated lately that the whole cost of maintenance of the Institution during the last 120 years has been little more than £100,000, not a twentieth part of the cost of one battleship. Yet the discoveries of Faraday alone have put untold wealth into the exchequers of nations and laid the firm foundations on which rest to-day the entire work of the modern electrical engineer."

Col. Sir H. Jekyll, K.C.M.G., a surviving founder of the Society, proposed a vote of thanks to the lecturer, and recalled that he had attended Faraday's Christmas lectures as a boy. Mr. C. H. Wordingham, C.B.E., seconded the vote, which was passed unanimously.

On Wednesday the first speaker was Col. R. E. Crompton, C.B., whose remarks are abstracted below:—

When in 1878 I commenced serious electrical work by installing Gramme dynamos and Serrin lamps to enable the newly designed pipe-moulding pits at the Stanton Ironworks to run through the night, I necessarily went to the Telegraph Engineers to learn the technicalities of the business. Telegraph engineers then calculated resistance in miles of iron telegraph wire, or they sometimes referred to "Siemens units" or "B.A. units," which differed by a small percentage from the present ohm. They talked learnedly of Webers, and expressed e.m.f. in numbers of Daniell cells. We were told that all sources of electrical energy, whether batteries or dynamos or magnetos, must have a considerable internal resistance as a kind of stand-point or kick off from which the electromotive force could make a start to press forward through the external resistance. Preece used to tell us that if we reduced the internal resistance of our dynamo armatures much below one half that of the external resistance in the circuit and lamps, we should work at a loss.

Early in 1879 I was introduced by the elder Brown, of Winterthur, the father of Charles Brown, of Brown, Boveri, to Emil Burgin, of Basle. I took up the manufacture of his form of dynamo, which undoubtedly was better from a mechanic's point of view than the Gramme machine. The latter was not very mechanical; on its spindle was mounted a wooden hub, and pressed on to it was the wound armature ring, which was very difficult to balance and to keep in position. The iron core of the armature was of very small section, and the winding, no doubt in order to obtain the much-desired internal resistance, was composed of a great number of coils of fine wire. Burgin's design laid the foundation of the Crompton firm. We were soon turning out at Chelmsford several Burgins per week; we got good prices, and we always sold two or three Crompton arc lamps with each dynamo. I thus got enough money together to enlarge the works, and took on as skilled manager Gisbert Kapp, who had up to that point been trained as a mechanical engineer with Messrs. Hornsby, of Grantham.

At that time such scientific assistance as I could get was from Sir William Thomson (afterwards Lord Kelvin), James Thomson, his brother, Rankin, and others.

One day a man came into my office and said: "I must take you on a mysterious journey." I was whisked off to Newcastle, and there introduced to Mr. Joseph Swan, who showed me a row of Swan carbon lamps lighted by a Gramme dynamo. Swan had sent for me because I had supplied his firm with arc lamps. Very shortly after I arranged to exhibit his lamps at an exhibition in Glasgow of the latest forms of gas and electric lighting; in the latter case we showed both arcs and Swan lamps. This exhibition got us several Scotch orders, and I installed Swan lamps in the Glasgow Post Office.

About this time the Brush and the Thomson-Houston form of lighting by arc lamps in series came over from America; this eventuated in the Father Brush boom, which depressed gas shares and was to revolutionise the lighting of the world. However, Swan went quietly on, and started his lamp company at Newcastle, and a larger company was founded in London by Cuthbert Quilter; this shortly afterwards amalgamated with the Edison interests to form the Edison Swan Company. I was made its advising engineer; it took over most of my installation work in progress, amongst it the Law Courts, which were then nearly finished, and which were the first really big job of lighting by Swan lamps in this country.

As far as I know the first regular installation of electric light in a country house was at Berechurch Hall, belonging to Coope, the brewer, and it was there, on finding a group of men who had completed the bell-hanging of the house, that we made them into electrical wiremen; most of them eventually became wiring contractors.

During the early days we were haunted by Preece's and the telegraph people's ideas of the necessity for the internal resistance, and this idea undoubtedly kept us back.

I think it was Rankin who first suggested the formula $4\pi \times$ ampere-turns/2 (air gap) as a measure of the magnetomotive force, and this was so useful to me as a mechanical man that I was always trying to persuade my designer, Gisbert Kapp, to cut down the double air gap; in other words, to confine the armature winding to one layer of turns. He was then against the proposal, but he went away for his holiday, and during his month's absence I pushed out a machine with gigantic wrought-iron field magnets and armature core and only one layer of winding on the armature. The machine was on the test bed ready to start the day that Kapp returned, and I well remember the expression on his face; he looked upon me as a foolish, ignorant man wasting my own money. However, as soon as the belt was on and the machine started, and at first there was little indication of magnetic field or electromotive force, Kapp began to say: "I told you so," when just as he spoke the field began to build up, and in a very short time reached a point far higher than I had calculated; the belt flew off under the load, *but the modern dynamo was born.*

Some weeks later I learnt from my friend John Hopkinson that he had been on exactly the same job, and at the same time had done for the drum form of winding what I had done for the ring form. We both exhibited at one of the inventions exhibitions at Kensington, and I got a gold medal.

At that time my partner was Harold Thomson. It is not generally known how many of the common appliances now in use were due to his inventive mind—switches, plug contacts, all kinds of fuse arrangements, cut-outs, the suspension of overhead lamps by their own flexibles, nearly all came from him, in collaboration with one of my foremen, A. P. Lundberg, who afterwards made quite the best line of switches and domestic fittings.

The burning of the Ring Theatre in Vienna was due to an escape of gas, and caused a terrible loss of life; the old Emperor said that he would not allow gas to be used in any of the Imperial theatres, and that the Imperial Continental Gas Co., which had the contract for lighting Vienna, must take up electric lighting as well as gas lighting. A French engineer, Monier, was appointed to advise them, but asked me to join him. Together we schemed out a central station on a large scale in the Schenkenstrasse, and Crompton's undertook the contract; I spent several years in Vienna working out this large job, in fact from 1884 to 1887.

At that time the Allgemeine was only just starting; Rathenau and Deutsch used frequently to come to Vienna to watch what I was doing, also Emil Garcke, who was then secretary to the Brush Company. Willans worked out with me the whole of the steam generators and electric governors, and it may be said that this installation was the prototype of the many central stations that were built during the 'nineties in London and in various towns in England, and which have given such very good results.

At an early date I wished to apply my Viennese experience to lighting parts of London, and licences were applied for by the Edison Swan Company to light large districts, but none of them were carried out, as the capital was not forthcoming owing to the short period, 21 years of life, laid down by the first Chamberlain Act.

Eventually I found that the Land Securities Company had at its Kensington Court estate a subway through which I could lay at low cost bare copper conductors, and thus connect up 50 or 60 houses with a central station built on a piece of ground at one corner of the site. Thus in 1888 the Kensington Court Electric Lighting Company, the first real lighting company, was started; among the first and largest shareholders were the late Lord Alverstone, who was then Richard Webster, Sir Frederick Bramwell, Frank Bolton (the head of the electrolytic copper trade), and a few others.

During the time I was at Vienna, Messrs. Gaulard & Gibbs were developing their adaptation of the previously known induction coils so as to use them as static transformers for converting a.c. from high to low pressures. About this time a very brilliant young man appeared on the scene—Ferranti. He took up the a.c. transformer method of distribution, and very soon he and I became the captains of two opposed schools of electrical distribution.

At the time I was starting at Kensington and canvassing householders to use the light, Ferranti and Lord Crawford started a distribution from the Grosvenor Gallery, and many interesting things occurred.

I at Kensington always had accumulators in reserve, so that I practically never had any extinction of light, whereas many extinctions occurred at the Grosvenor Gallery, and many amusing stories could be told of the horror of chaperones when the ball rooms were suddenly plunged into darkness. How could I preach safety and continuity of electric lighting at

Kensington when such strenuous and scandalous proceedings went on in Mayfair and Belgravia? Whereas Ferranti said no shareholders would find money for such improper devices as accumulators, I said no mothers would allow their families to attend balls which depended on a.c. and transformers.

But soon the battle ground was shifted to the theatre of this Institution, and many of you will remember the very long and interesting debates that took place, which I believe had the very desirable effect of calling attention to the interesting nature of our profession and brought in many recruits from amongst the young engineers of the time.

In May, 1883, we, the electrical fighters of the time, started a Dining Society; we were there able to meet and discuss in peace matters other than those electrical. We christened it the "Dynamicables." By August of that year there were about 100 members, and during the following five years every electrical man of note joined us, so that our numbers rose to about 250 in 1888. At our dinners at the Aquarium we forgot all about the electrical strife of the working day, and many lasting and pleasant friendships were then made.

During the time we were working at Vienna we found out that the old style of measuring instruments had not capacity enough for dealing with very large currents and the electromotive force that we were beginning to use. Monier and I between us developed a simple method of measuring current going through our feeder mains by measuring the fall of potential over a measured length of copper main, using a delicate d'Arsonval galvanometer, and noting its deflection. We thus readily got a scale in hundreds of amperes.

During the short time I was at home working at my laboratory, Fleming helped me to develop the potentiometer, and he sketched out a very simple resistance frame in order to get the accurately-measured resistance across which we could measure the fall of potential.

I then had an assistant in my laboratory named Fisher, and another, Sydney Melsom, now at the N.P.L. They will remember the interesting time we had in perfecting the potentiometer to a sufficient extent to enable us to make measurements of current and e.m.f. correct to four places of decimals, which then became a standard means of testing the very great refinement which about this time took place in dynamo and engine efficiency.

Many will recollect the interesting competitions between rival dynamo makers when their machines were coupled to Willans engines and tested on the test bed at Willans's works at Thames Ditton. These competitive trials were accurately measured, and showed quite unexpected efficiency between the indicated horse power of the steam engine and the actual output at the dynamo terminals. This undoubtedly put England, for some time, far in advance of any nation in the world in the perfecting of this class of machinery.

Some of you may recollect the very interesting trial when Harness brought an action against Messrs. Alabaster and Gatehouse for libelling him by saying that his electropathic belts, which were so greatly advertised, really were a fraud and contained no means of generating electrical force. We made Alabaster's body into a standard resistance and attempted to use the Harness electropathic belt as a source of e.m.f., but with negative results. I am glad to say that largely due to these experiments Alabaster & Gatehouse won their case.

When we began to lay mains in the streets of London I carried out my first work in the Kensington Court subway by using bare copper conductors stretched over porcelain insulators, constructing many miles of small subways under the foot pavements of the West End of London. In these my bare copper conductors were similarly strained, and they have always given excellent results. After a lapse of 40 years these copper conductors are still in use and in the same good condition as when they started, and they will probably outlast some of us.

I think I ought to claim for the pioneer engineers of those days that we *did* make good as compared with our brother electrical men in America, Germany, and France.

Rathenau and Deutsch, who founded the Allgemeine, came to us at Vienna to learn their business; their early attempts on large generating machinery were positively comic, huge Gramme rings with internal star-shaped magnets, the Gramme rings being about 20 ft. in diameter and serving as the fly-wheels of Van der Kirchove engines. The output was smaller than that of the 200-h.p. Willans combined sets that we were using at Vienna at the time, which occupied one-tenth of the cubic space, and were far more economical.

Annual Dinner.

On Tuesday last the annual dinner of the Institution was held at the Hotel Cecil; there was a record attendance, numbering over 500. In the unfortunate absence of the President, through illness, the chair was taken by Dr. W. H. Eccles, F.R.S., vice-president. Amongst the guests and members present were Mr. F. G. Kellaway, M.P., Lord Southborough, P.C., G.C.B. (hon. member), Sir Charles A. Parsons, K.C.B., F.R.S. (hon. member), Air-Marshal Sir H. M. Trenchard, K.C.B., D.S.O. (chief of the air staff), Sir Anthony Bowlby, K.C.B. (Pres. Royal College of Surgeons), Sir J. E. Petavel, K.B.E., F.R.S. (director N.P.L.), Sir William Noble (engineer-in-chief, G.P.O.), Sir William Pope, K.B.E., F.R.S. (acting president Society of Chemical Industry), Sir Andrew Ogilvie, K.B.E., C.B., Sir James Devonshire, K.B.E. (hon. treasurer), Sir S. Chauman, K.C.B., C.B.E. (Perm. Sec. B. of T.), Sir A. J. Durrant, C.V.O., C.B.E. (H.M. Office of Works), Mr. A. Page (Electricity Commissioner), Sir R. T. Glazebrook, K.C.B., F.R.S. (Past-Pres. I.E.E.), Mr. C. H. Wordingham, C.B.E. (Past-Pres. I.E.E., chairman B.E. and A.I. Research Association), Mr. Justice Sargant, Prof. Sir W. H. Bragg, K.B.E., F.R.S., Dr. A. Russell (Pres. Physical Society of London), Mr. C. E. Musgrave (Pres. Chartered Institute of Secretaries), Mr. Stanley Machin (Pres. London Chamber of Commerce), Mr. C. C. Paterson, O.B.E. (Vice-Pres. I.E.E.), Dr. H. S. Hele-Shaw (Pres. Institution of Mechanical Engineers), Mr. Roger T. Smith (past-Pres. I.E.E.), Dr. S. Z. de Ferranti (past-Pres. I.E.E.), Col. R. E. Crompton, C.B. (Past-Pres. I.E.E.), Prof. E. Barker (Principal, King's College, London), Mr. A. A. Campbell Swinton, F.R.S. (Vice-Pres. I.E.E., and chairman of Council, Royal Society of Arts), Dr. E. P. Cumberbatch (Pres. Electrotherapeutic Section, Royal Society of Medicine), Prof. A. W. Porter, F.R.S. (Pres. Faraday Society), Mr. J. Bowden, O.B.E. (Chief-Superintendent, Ordnance Factories, Woolwich Arsenal), Mr. C. D. le Maistre, C.B.E. (local hon. sec. American I.E.E.), Mr. W. Vaux Graham (chairman Association of Consulting Engineers), Prof. J. W. Nicholson, F.R.S. (Pres. Roentgen Society), Mr. J. MacGregor (chairman Cable Makers' Association), Mr. Alfred Carpmael (hon. solicitor I.E.E.), Mr. G. W. Humphreys, C.B.E. (chief engineer L.C.C.), Mr. Ll. B. Atkinson (Past-Pres. I.E.E.), Sir H. C. Mance, C.I.E. (Past-Pres. I.E.E.), Mr. C. P. Sparks, C.B.E. (Past-Pres. I.E.E.), Mr. P. F. Rowell (secretary I.E.E.), and many Members of Council, Chairmen and Hon. Secretaries of Territorial Centres, and other distinguished men.

At the commencement of the proceedings, the chairman announced that a message of sympathy was being transmitted to the President regretting his enforced absence from the dinner, and after the loyal toast, Dr. Eccles stated that the President had replied expressing his thanks. Greetings were received from the Duke of York, who regretted his inability to be present, and expressed the hope that the Institution would continue to prosper and render the same yeoman service in the future as it had done in the past for the benefit and advancement of the science, commerce, and industry of the country; congratulatory messages were also announced from the American Institute of Electrical Engineers, the French Society of Electricians, the Italian Electrotechnical Association, the Dutch Royal Institute of Engineers, the Association of Managers of Dutch Electricity Undertakings, Mr. Thomas A. Edison, Sir John Snell (unavoidably absent, at the North-West Midland Inquiry), and from the Institution of Gas Engineers.

Proposing the toast of "The Institution," Mr. Kellaway remarked that during the 50 years that the Institution had been in existence the relations between it and the Post Office had been close and friendly. When it was founded, telegraphy was the chief branch of electrical engineering; since then developments had taken place which had revolutionised the conditions under which modern society existed, and that Institution had played a great part. In view of what had been accomplished, who could place a limit to the science and art in which the members were engaged? The engineer had a more excellent part to play than the politician; while great political changes were in progress, the work of scientific development and research went steadily on, producing results which added to the sum of human happiness. It should be the politicians' task to see that their energies were set free to develop themselves under the most favourable conditions. He was proud of the part that British ingenuity and audacity had played in this great development.

Responding, Dr. Eccles said that this was a great week for the Institution, commemorating the 50th anniversary of the first meeting of the Society of Telegraph Engineers, and holding the first dinner since the King had bestowed his patronage and a Royal Charter on the Institution. He expressed the gratitude of the Institution to Mr. Ll. B. Atkinson, the immediate past-president, for the energy and skill which he had displayed in conducting the negotiations. The Institution, which 50 years ago numbered 110 members, had now over 10,000, and was the largest professional engineering institution in the country. The reason for this growth might be that electrical engineering had more varied applications than any other kind of engineering, and must necessarily play a greater and greater part in the life of the people. As electricity had, in a sense, become the life-blood of the country, it became the object of attack by disaffected parties; hence it was necessary for the statesman to use electrical engineers more fully than in the past and to study their requirements more completely.

Mr. Ll. B. Atkinson, proposing "The Guests," said the Institution might be judged by the distinguished company it kept. The Postmaster-General employed a greater number of electrical engineers than any other employer in this country, and thanks to Sir William Noble's efforts, a large proportion of them were now members of the Institution.

Air-Marshal Sir H. M. Trenchard, responding, drew attention to the great importance of wireless telegraphy to the air service, which without it could never develop its full power.

Mr. Justice Sargant, also responding, said that the extraordinary advance of electricity in all its practical uses was due to its being based on the solid foundation of scientific research, with a superstructure of great practical ability.

The dinner was accompanied by an excellent programme of music, and followed by a reunion of members, which was prolonged to a late hour, the proceedings being exceptionally successful and enjoyable.

PARLIAMENTARY NOTES.

(By Our Parliamentary Reporter.)

L.B. & S.C. Electrification Scheme.—In the House of Commons on Monday Mr. Lambert asked the Prime Minister if his attention had been directed to the statements of the chairman of the London, Brighton & South Coast Railway that the company had full plans for a suburban scheme for electrification; that it was ready to set to work at once, but was prevented by the paralysing effect of the Railway Act, which prevented any large schemes of electrification being executed without the consent of four other railway companies; and whether, in the interest of railway enterprise and the urgent need for providing employment, he would announce the early repeal of the Railway Act, 1921.

Mr. Neal, Parliamentary Secretary to the Ministry of Transport, who replied, said that his attention had been called to the statements made at the meeting in question, and he might point out that other reasons were given besides that mentioned in the question. The answer to the last part of the question was in the negative.

Electric Tramways for Edinburgh.—In the House of Commons on Monday Major Glyn asked the Parliamentary Secretary to the Ministry of Transport whether, if application be made by the City of Edinburgh Council for leave to set up central standards for overhead trolley electric tramcars throughout the length of Princes Street and other parts of that city, he would see that no leave be granted until the opinion of the residents of Edinburgh had been ascertained and careful inquiry made on the spot into the whole matter.

Mr. Neal replied that a scheme for equipping the Edinburgh tramways for electrical traction, which involved the erection of central standards in Princes Street, had been submitted for approval. Any objections communicated to the Ministry by residents of Edinburgh would be carefully considered before a decision was given, and if, after such consideration it seemed necessary, an inquiry would be held.

Underground Railway Wages.—In the House of Commons on Monday Mr. Grattan Doyle asked the Parliamentary Secretary to the Ministry of Transport if his attention had been called to the fact that the men employed on the Underground and Electric Railways of London had during the past seven months submitted to three reductions in wages aggregating 13s. per week per man; that the managers of such companies were allowed to increase fares by over 30 per cent. on account of such advanced wages; and whether, since an obligation rested on them to reduce their fares to the public *pro rata* to the men's reductions, and the Minister of Transport, in conjunction with the Railway Commissioners, sanctioned increased fares for the reasons stated, he would call the attention of the directors and managers to the matter in order to have it revised, and to give the public the advantage or, failing that, would he raise wages to the level of last spring?

Mr. A. Neal replied that the London Electric Railways (Fares, &c.) Act, 1920, provided for certain increases in fares in order that the charging powers of the companies might provide for working expenses, efficiently maintaining and renewing the undertakings, and a reasonable return on capital. Hence factors other than wages had to be taken into account in determining the fares to be charged, and the increased fares had not been sanctioned solely on account of advances in wages. The financial position of the companies had been under consideration by the Minister from time to time, and he had already been furnished with copies of the annual accounts for 1921 in order that the position which arose under Section 6 of the Act might be again considered.

Electrical Imports from Germany.—Replying to Mr. Newbould, Mr. Baldwin, President of the Board of Trade, said that in 1913 Germany imported into this country 5,978 tons of electrical machinery of the value of £721,000; in 1921 the figures were 241 tons and £44,996.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR JANUARY, 1922.

The January returns of electrical business show considerably increased values in the export section as compared with the previous month; the total for electrical exports being £1,369,473, as against £1,063,154 for December, an increase of approximately £300,000; the principal increase occurred in the items for electrical machinery (£300,000 increase), while electrical goods and insulated wire exports also reached higher values than in December. Telephone and telegraph export totals fell off to the extent of about £40,000.

The electrical imports for the month totalled £158,581, as against £174,090 for the last month of 1921; decreases occurring in glow lamps, meters and electrical machinery imports, but in other directions increased values obtained.

The re-export total for January is £1,000 better than the December figure of £14,161.

The total weight of electrical machinery exported during the month amounted to 1,958 tons, as compared with 1,196 tons for December, 1921, and 1,846 tons for January, 1921 and 2,528 tons in January, 1913.

Values of Electrical Exports and Imports for January, 1922.

	Exports.	Imports.	Re-Exports.
Electrical goods and apparatus ...	£122,920	£50,200	£4,522
Insulated wire	180,086	8,140	435
Glow lamps	29,010	19,036	93
Arc lamps and parts	1,488	567	70
Batteries and accumulators ...	33,394	3,650	—
Meters and instruments	36,466	5,833	32
Carbons	6,743	2,647	875
Electrical Machinery—			
Railway and tramway motors ...	15,878	—	—
Other motors and generators ...	344,499	—	—
Switchboards (not telegraph or telephone)	85,975	945	72
Electrical machinery (unenumerated)	206,887	46,871	3,114
Telegraph and telephone cable and material—			
Telegraph and telephone wire and cable (not submarine) ...	81,663	3,497	—
Submarine telegraph and telephone cable	3,393	—	—
Telegraph and telephone instruments and apparatus	221,071	17,195	6,066
Totals	£1,369,473	£158,581	£15,279

LEGAL.

Newmark *v.* Semco, Ltd.

In the Shoreditch County Court, on February 16th, before Judge Cluer, Mr. Louis Newmark, of 120-134, Bishopsgate, E.C., watch importer, sued Messrs. Semco, Ltd., of 19-20, High Street, Shoreditch, to recover £97 15s. for fraudulently misrepresenting that a 2-kW air-cooled petrol-electric generating set was practically new, and had only been run for two hours, whereas it was old and worn, and in an unfit condition. Mr. W. Warren appeared for the plaintiff, and Mr. A. G. Robinson for the defence. It was explained that the set was required for a house the plaintiff was having built at Rickmansworth, and was sold at the end of December, 1920, for £80.

Herbert Newmark, son of the plaintiff, said that early in the December of 1920 he went to the defendants' premises with a Mr. Jay, an electrical engineer, and saw this generating set, and was told it was practically new, and had only run for two hours. After it was installed it was continually misfiring and usually stopped. He was never told it was second-hand. Later, after his visit to defendants, his father saw it with an architect, and Mr. King, an electrical engineer, and the purchase was decided upon. When it was supplied it was guaranteed to carry a full load and run for two hours. In April an unsuccessful attempt was made to work the engine. A second attempt was made in May, when it was found that, owing to faulty wiring, there were some dead shorts. Capt. Wood had the matter in hand for the defendants, and in the August there was a fairly successful trial. After that witness—aged 17 years—was running the generator. He denied that Capt. Wood told him constantly that it was under-lubricated. About this time the flywheel broke, and later the crank-shaft. He agreed that Capt. Wood complained that the concrete bed was not right, but he understood it was put right.

Mr. Harold Brine, architect, said he built the house at Rickmansworth. He heard the representative of Messrs. Semco say it was practically new, and had run only two hours.

Mr. King, electrical engineer, spoke of the same thing. As to the faulty wiring, he put that right in half an hour.

Mr. Louis Newmark said he understood it to be "unused war stores." Before buying he asked if it was in perfect condition, and had the same said to him as the other witnesses had doposed to. The machine had never carried its full load. He concluded he had been defrauded when the crank-shaft broke in October. That was after Capt. Wood had finally left the premises.

Mr. Wm. Payne, general manager to Jones & Sons, electrical engineers, of Rickmansworth, said he was asked to look

at the set, and advised a lot of things to be done which would certainly not have been necessary had it been in perfect running order. The defendants had these carried out by Messrs. A. Thompson, electrical engineers, of Chorley Wood.

For the defence, Mr. Clarence Rapson, managing director of the defendants, said the set was purchased on September 1st, 1920, and he had never authorised anyone to make the representations suggested; it was not war stores.

Judge Cluer: If anyone made a false statement Mr. Rapson, as an honest man, would make amends.

Ernest Anderson, the salesman, denied using the words attributed to him.

Capt. Norman Wood was called, and said that not a word was said by him about guaranteeing it. He gave directions as to the concrete bed, which were not carried out, so that it was impossible to ensure sufficient cooling. In April, when started up, it back-fired, and so hurt his arm that he was unable to go on with the work for some time. On August 9th he got a perfect test, and it took a full load for the required time. After that the Newmark family took it over. He saw it after, and it was under-lubricated. On October 1st he gave it an economy test and ran it for twelve hours on paraffin, and it went well.

In giving judgment, Judge Cluer said he did not think the defendants had satisfied their guarantee that it was in perfect running order, and although it was tested up to two hours that did not mean it was to just do that and stop. On these grounds only he should award the plaintiff £35 damages and costs.

Foster *v.* British Thomson-Houston Co., Ltd.

In the Mayor's and City of London Court, last week, Albert G. Foster, engineering draughtsman, claimed £8 2s. 9d. from the British Thomson-Houston Co., Ltd., electrical engineers, London, E.C., salary for nine working days at 18s. 1d. per day.

Plaintiff's case was that he entered the defendant's service in May, 1920. Part of his engagement was that he should receive certain holidays each year and be paid his salary in full. In 1920 he had his holiday, and was duly paid. Last year a notice was exhibited inviting the staff to say when they would like to take their holidays, and plaintiff put down June. Through slackness of work he was dismissed on May 9th, and left on May 19th. His claim now was for the payment of the nine days' holiday which he would have had in June because of the special contract that he should have an annual holiday with payment of salary.

Judge Atherley-Jones, K.C., said what the claim came to was that all the employers' rights would be suspended until the plaintiff had had his holiday and that the defendants must pay him for his holiday. The employers must keep the man in the service until he had had his holiday, if the plaintiff's claim was justifiable.

Mr. Maddocks, for the defendants, said, of course, that position was wholly untenable. There was no contract to give a holiday, and it was only given *ex gratia*, payment, of course, being made if the men were still in the service, but not otherwise. There were 800 to 1,000 men on their works staff, and their whole organisation was about 5,000 to 6,000.

Judge Atherley-Jones said that to a very large extent the relations of employer and employed in this country were regulated by custom, and very often those customs gave rise to conflicts. The case was very important. If he found for the plaintiff it would frustrate the benevolent intentions of employers with regard to holidays and it would be abhorrent to common sense. Judgment for the defendants, with costs.

Electro-Metals, Ltd., *v.* Malleable Steel Castings Co. (1909), Ltd.

In the King's Bench Division, Mr. Justice Sankey again had before him the above action.

Mr. Edward Yates Walsh, giving evidence for the defence, said Mr. Bibby came to see him with regard to his buying a furnace on February 17th, 1918. He took Mr. Bibby round the defendants' works, and showed him the nature of their business and told him what he wanted. Witness also showed Mr. Bibby the four annealing ovens he had there for malleable iron, and pointed out what a cumbersome process it was. Mr. Bibby said he could do away with the process altogether, and that if he had castings of a certain shape they could be put into a small oven and let down. Witness understood that it would not be necessary to anneal castings in the same way as malleable iron. Witness told him he would want at least 40 tons tensile strength per sq. in., with 15 per cent. elongation, and Mr. Bibby said it could be got without annealing. The consumption of electricity for a 30-cwt. furnace, Mr. Bibby said, would be 800 kWh, and that would be the top figure. Witness was present at the first heat, which took place on July 29th, 1919, and at subsequent ones. The moulds were properly made and dried, and they had everything necessary for the business of steel castings. The furnace, however, never ran satisfactorily, or as a commercial proposition. A lot of the castings made were returned by customers, although some had been taken. His firm had never taken over the furnace. The defect was that the castings were brittle. The electrodes often broke, and those he had left after the furnace was shut down he sold to Messrs. Bamforths, of Luton. With regard to consumption of electricity, they never had a run in which the furnace used only 800 kWh per ton in the ladle. There was no truth in the suggestion that the foundry roof leaked and the moulds got wet.

Mr. H. Kitchin, engineer in the employ of Messrs. T. Bamforth & Co., Ltd., Luton, said he had had experience in the installation and working of electric furnaces, and had one under his charge at the present time. In his experience it was quite possible to get steel of from 35 to 40 tons tensile strength per sq. in. with 15 per cent. elongation with ordinary letting down, and he regarded that as quite a reasonable requirement. It could be done without annealing. The equipment of the defendants' works, which he had visited, was reasonable, and their small oven was suitable for annealing steel castings. The castings he saw were not fit to be used as steel castings. He thought the cause was wild steel. The balance of the electrodes from the defendants' works which his firm had purchased had been used with satisfactory results. Witness had seen the charge sheets from the working of the furnace and ascertained that the average consumption of electricity was 1,631 kWh per ton in the ladle. His own furnace was of 25 cwt. capacity, and its consumption averaged 1,100 kWh per ton in the ladle. They had two heats per day and non-continuous running. If they had electrode or electrical troubles during a heat, that generally meant a troublesome heat, and often a bad one. With its high consumption of electricity, the furnace sold to the defendants could not be run commercially.

Other evidence as to the working of the furnace was given by defendants' employés.

The hearing was adjourned.

British Thomson-Houston Co., Ltd., *v.* Corona Lamp Works, Ltd.

The hearing of the above action was concluded before Mr. Justice Astbury in the Chancery Division on February 16th.

Mr. Horatio Ballantyne, for the defendants, gave evidence, and said he had acted as scientific adviser and scientific witness in cases connected with electric lamps for many years. In 1912, the date of this patent of the plaintiffs, he was already familiar with some of the problems connected with sealing in current leads into electric lamps.

Sir D. Kerly, K.C., examining: You have read the specification in this case; did it convey to your mind, whatever its true construction may be, an idea as to what was meant by a coefficient of expansion of the wire to be compared with that of glass?

Witness: The specification certainly conveyed to me the meaning of obtaining a coefficient corresponding to that of the glass, and I knew what to do to carry that out. The procedure, as I understood it, was to ascertain the coefficient of expansion of the wire by measuring its increase in length throughout a period of heating.

Was it or was it not common knowledge that you must have a wire with the appropriate expansion of glass?—Yes.

Cross-examined by Sir A. Colefax, K.C., for plaintiffs: Do you agree with this, that you do not find disclosed in any of the alleged anticipations the subject matter of the plaintiffs' patent?—I certainly do not find in them anything about proportioning so as to get the coefficient of expansion of a certain kind.

The answer is that you do not find the subject matter disclosed?—If that be part of the subject matter, I don't.

Dr. G. Holst, head of the Physical Laboratory of Messrs. Phillips' Lamp Works at Eindhoven, Holland, said they began making copper-clad nickel-iron core leading-in wire for their lamps in 1914. He did not know at that time of the plaintiffs' specification. They used copper-clad nickel-iron-core leading-in wire in consequence of a communication they had that it was used by other factories, and so they began to try it themselves without any assistance as to how they were to make it.

Mr. Augustus Charles Hyde, a maker of leading-in wires, said he was with the late Sir Joseph Swan, of Edison and Swan fame. He was the Mr. Hyde whose patent had been read in this case. He and the Vactite Company worked on friendly terms with La Société Fourchambalt, whose patent had also been put in, and they were both concerned with nickel-iron leading-in wires.

Mr. Cecil M'Masters, stores manager of the Corona Lamp Works, Ltd., gave evidence as to identifying certain lamps complained of as infringements. They had been dealt in by his company, and they had been got from America, being delivered to them by the Express people.

This concluded the evidence, and his Lordship reserved judgment.

Cable-Jointer Committed.

At the Clerkenwell Police Court, Thomas Hutchinson, 49, cable jointer, was charged, on remand, with converting to his own use and benefit the sum of £187, received by him on account of the members of the Islington Borough Council Electricity Department Sick and Benefit Society. He was committed for trial at the Central Criminal Court.

BUSINESS NOTES.

Bankruptcy Proceedings.—Ernest Fawcett, 20, St. Anne Street, Liverpool, electrical and heating engineer.—The public examination of this debtor was held on February 13th at the Court House, Victoria Street, Liverpool. The statement of affairs showed unsecured liabilities of £349 against net assets 14s. 11d. Questioned by the Assistant Official Receiver, debtor said that he filed his own petition. It appeared that he served an apprenticeship as an electrical, heating, and hydraulic engineer, and afterwards for some years he worked for various firms of engineers. In August, 1920, he became connected with an electrical company, in which he invested £500, and of which he was appointed a director. The company carried on business at 20, St. Anne Street, Liverpool. It was not successful, and went into voluntary liquidation on June 1st last year. Debtor believed that the liquidator had realised the whole of the assets. He stated that he found out that the company was not a success about January or February last year. It had improved considerably when the heating department was taken on, and debtor became surety for a bank overdraft of £500, along with two other directors. He estimated that £250 of that would rank against his estate for dividend. In August, 1921, he commenced business in partnership with another gentleman, who found all the capital of £250. The business was similar to that of the company, and it was successful until January this year. According to the terms of the partnership it was to be dissolved on the bankruptcy of either partner. The condition was that the surviving partner should take over the business with all the debts and assets. Proper books of account had not been kept. The whole of the household furniture was claimed by debtor's wife. The examination was closed.

C. Pollard, electrical engineer, 12, Corporation Street, Halifax.—Receiving order made February 14th on debtor's own petition. First meeting, February 24th. Public examination, March 24th, both at the County Court, Halifax.

T. Davison (Radio Technical College), 30, Falkner Street, Liverpool.—Receiving order made February 15th on debtor's own petition.

H. Truelove (H. Truelove & Co.), electrical engineer, 19, Shepley Street, Stalybridge.—First meeting, March 3rd, at the Official Receiver's Offices, Manchester. Public examination, March 6th, at the Town Hall, Ashton-under-Lyne.

A. R. Meggett, electrical engineer, 45, Thrumpton Lane, East Retford, Notts.—Trustee: Mr. F. C. Brogden, Official Receiver, 10, Bank Street, Lincoln. Released January 19th.

Edwin Growdon Langsford, 24, Bar Street, Burnley, late 74, West Gate, Burnley, electrician.—The following are creditors:—

	£		£
Butterworth, C.	27	Newsholme, J.	100
Baldwin, S.	13	Sharples (exors. of)	60
Clegg, T.	20	Smithson (F.) & Sons	12
Nersholme, Mrs.	36	Levi, Todd	24
Pollard, Ellen	11	Whende, J.	20

Mihill Loraine Slaughter, 91, Victoria Street, S.W.—This debtor attended at the London Bankruptcy Court on Tuesday before Mr. Registrar Mellor for public examination upon accounts showing total liabilities £12,688 (unsecured £10,898) and assets valued at £2,210. In the course of his evidence, the debtor said a company was registered in March, 1920, as "M. L. Slaughter & Co., Ltd.," to acquire and carry on his agencies. In August, 1921, the company purchased from the Astral Intensifier, Ltd., for £2,000 in shares the exclusive British rights for the manufacture and exploitation for five years of an intensifier or reflector for electric lamps, of which the Astral Co. held the patents. His company agreed to manufacture and sell 250,000 intensifiers per annum, and to pay a royalty of fourpence on each one to the Astral Co. Subsequently his company appointed Overseas Contracts, Ltd., to be their selling agents for the whole of Great Britain, provided they sold 300,000 intensifiers per annum. The retail price was fixed at three shillings; they manufactured the reflector at one shilling (out of which they had to pay fourpence to the Astral Co.), and sold it to the Overseas Contracts, Ltd., for two shillings. Had this contract been carried through his company's profits would have been about £10,000 per annum, but the Overseas Contract Co. failed to carry it out, and went into voluntary liquidation in April, 1921. Owing to that failure witness's company was unable to meet its obligations, and also had to go into liquidation, and that in turn brought down witness, he having incurred heavy liabilities on behalf of the company. The inquiry was concluded.

Company Liquidations.—Frank Rawcliffe & Co., Ltd., electrical factors, 8, Nunn Street, Newcastle-on-Tyne.—A meeting of creditors was held on February 16th at 50, Gresham Street, E.C. The chair was taken by Mr. W. Brittain, the liquidator under the voluntary winding-up. A statement of affairs reporting the position as at January 30th last showed liabilities to unsecured creditors £14,325, while the assets, after allowing £204 for preferential claims, were estimated at £11,329. The assets comprised stock-in-trade, at present prices £9,282; trade fixtures, fittings, utensils, &c., estimated to realise £526; good book debts, £1,359; and bad and doubtful debts, £1,452, estimated to produce £366. There was therefore an estimated deficiency disclosed of £2,996, while as regards shareholders the total deficiency was £11,466. It was stated that the issued capital of the company amounted to £8,470. The company was formed in April, 1921, and took over the existing business of Mr. Rawcliffe. The business had been successfully carried on for some years by Mr. Rawcliffe, and the company took over all his liabilities. Mr. Rawcliffe was now a cash creditor for £3,500. The stock had been carefully listed and marked down to current prices, and Mr. Rawcliffe expressed himself as being confident that had additional capital been procured for the business the concern would have continued satisfactorily as in the past. The shareholders discussed the position, and decided that the only thing to do was to go into voluntary liquidation. He (the liquidator) was instructed, on behalf of the directors, to submit an offer to the meeting of 10s. in the £, and it was proposed that there should be a scheme for the transfer of the whole of the assets to a new company, and that a debenture should be issued in respect of those assets for an amount necessary to pay the composition referred to by instalments of 2s. 6d. each at three, six, nine, and twelve months. The debentures would no doubt bear interest at 5 per cent. or some similar rate. In consideration of the creditors accepting this scheme, Mr. Rawcliffe would suspend his claim of £3,500 for the time being. In reply to a creditor, the chairman said that the new company would really be Mr. Rawcliffe himself. One creditor pointed out that the assets amounted to £11,000, and it was now proposed that 10s. in the £ should be paid. He would like to know whether that was the proposition.

Mr. Houston pointed out that the way to regard the matter was rather what would happen if the assets were realised by forced sale, and suggested that he would be a bold man who would say that in these circumstances the assets would realise any such figure as 10s. in the £. The creditors would be well advised to consider the fact that they would be able to regard the company in the future as a solvent company carrying on business under much better conditions, and it would be a great disadvantage to break up the business if another and better course could be found.

Several creditors asked questions with regard to the stock, and on seeing the stock figures said that they could not agree that the figures put forward represented the trade figures to-day.

After some discussion it was resolved, on the motion of Mr. Houston, representing Stella Conduits, Ltd., seconded by Mr. C. G. Poppleton, representing other creditors, that the liquidation should be continued with a committee of inspection consisting of Mr. Maurice (Catchpole & Maurice), Mr. E. A. Ingold, and the representatives of Stella Conduits, Ltd.; Mr. Joseph, of Messrs. Joseph & Co., and Callender's Cable and Construction Co., Ltd. The following are creditors:—

	£		£
Allan & Co.	13	Shaw (G. C.) & Co.	22
Bankers	3,583	Torby & Co.	31
Bainbridge & Co.	11	Walker (H.) & Sons, Ltd. ...	27
Favell & Co.	154	Law Accident Insurance Society	75
Wilkinson & Simpson	14	Chloride Electrical Storage Co.	15
Atkinson, T.	11	Baxendale & Co.	42
Catholic Home Journal	11	Northern Steel & Hardware Co.	95
Crossley (T.) & Co.	11	Rawcliffe (W. T.), Ltd. ...	27
Alliance Box Co.	48	Alderson & Glyde	14
Attwater & Sons	45	Canning (W.) & Co., Ltd. ...	372
British Thomson-Houston Co. ...	29	Eaton S.) & Sons	66
British Insulated & Helsby Cables	16	Heath (S.) & Sons	62
		Joyner (C.) & Co.	30
B.T.T. Electric Lamp & Accessories	591	Metallic Electric Eng. Co. ...	10
		Whitehouse (W.) & Co., Ltd. ...	18
Cable Accessories Co.	135	Cryselco, Ltd.	251
Callender's Construction Co. ...	820	Carron & Co	39
Catchpole & Maurice, Ltd. ...	234	Electric Accessories Co. ...	81
British Driver Harris Co. ...	486	Ingold, Ltd.	628
Efandem Co.	120	Kent & Co.	210
Enfield Ediswan Cable Co. ...	148	Middlesbrough Steel Tubes and Conduits Co.	16
English Electric and Siemens Supplies	30	Phœnix Supply Co.	41
Falk, Stadelmann & Co. ...	88	Preston, Mrs.	500
Jerrard, Darby & Clegg	21	Satchwell & Gettings	23
Johnson & Phillips	38	Rawcliffe, F.	3,500
Joseph & Co.	188	Rhodes Motors, Ltd.	50
Leach & Co.	16	Robson, T. R.	15
Lowe & Sons	53	Sanders (W.) & Co.	48
Newburn, Ellis & Co.	17	Robb Bros. (Glasgow), Ltd. ...	76
Morley, Ltd	13	Scupham & Wood	10
Moue, Claire & Co.	12	Stella Conduits Co.	247
New Italian Art Assn.	26	Smith (F.) & Son	11
Roberts (T. R.), Ltd.	47	Smith, H. W.	22
Rawlplug Co.	37	Underwood (Manchester), Ltd. ...	42
Siemens Bros.	23		

R. B. Hand & Co., Ltd., in voluntary liquidation.—The joint liquidators (Messrs. P. J. Hooper and W. A. J. Osborne) report that the realisation of the assets in this matter has now been practically completed. The committee of inspection has confirmed their accounts. The liabilities have increased somewhat. In connection with the book debts, there were a large number of discrepancies, which resulted in a smaller value being realised. A first and final dividend of 2s. 2d. in the £ is now being declared.

Carburation (Temperature Control), Ltd.—Winding up voluntarily. Liquidator: Mr. R. H. Porter, Austin Friars House, E.C. Meeting of creditors, February 27th.

Remco Carbon Co., Ltd.—Winding up voluntarily. Liquidator: Mr. R. Crane, 46 and 47, London Wall, E.C. Meeting of creditors, March 2nd.

Westinghouse Metal Filament Lamp Co., Ltd.—Meeting called for March 21st at 2, Norfolk Street, Strand, W.C., to hear an account of the winding-up from the liquidator, Mr. F. Owen.

Sherardizing Syndicate, Ltd.—Meeting of members, March 22nd at 70, Chancery Lane, W.C., to hear an account of the winding-up from the liquidators, Messrs. P. J. R. Warner and C. J. Jones.

National Engineering Co., Ltd.—Winding up voluntarily. Liquidator: Mr. A. N. Dudley Smith, Norfolk House, Laurence Pountney Hill, E.C.

Rushmores (1919), Ltd.—Winding up voluntarily. Liquidator: Mr. T. D. Addis, 26a, Peterborough Road, Parsons Green, S.W.

Welding, Son & Co., Ltd.—Winding up voluntarily. Liquidator: Mr. C. Hodgson, 70, Central Buildings, 41, North John Street, Liverpool. A meeting of creditors was called for February 23rd.

Heads Electrical, Ltd.—Meeting, March 22nd, at 151-152, North Street, Brighton, to hear an account of the winding up from the liquidator, Mr. A. E. Orbell.

Dissolution of Partnership.—Universal School of Telegraphy, 335, Oxford Road, Manchester.—Messrs. G. G. Boulaye, J. Griffin, and C. V. Morris have dissolved partnership. Mr. Griffin will continue the business under the same style and at the same address.

Trade Announcements.—The business known as the Thanet Electrical Co., 262, Northdown Road, Margate, will in future be known as the Margate and District Electrical Co., Ltd., and will be under the control of Mr. J. M. Keenan, A.M.I.E.E.

Catalogues and Lists.—Messrs. Oldham & Son, Ltd., Denton, near Manchester.—Descriptive circular, No. 139, dealing with and illustrating the "Oldham" miners' electric safety cap lamp.

Messrs. Archibald Low & Sons, Ltd., Merkland Works, Partick, Glasgow.—Catalogue No. E.C. 5122, giving illustrations and prices of "Highlow" electric heating and cooking appliances.

Messrs. Shenton & Co., Ltd., 68 & 69, Shoe Lane, E.C.4.—A net trade price list (No. 122) of electrical accessories, including wires and cables, adaptors, lampholders, conduits, &c.

Messrs. E. P. Allam & Co., 107-109, Gray's Inn Road, W.C.1.—February stock list of a.c. motors of from 1 to 50 h.p.

Messrs. Johnson & Phillips, Ltd., Charlton, S.E.7.—"Transformer Abstracts" No. 5, describing the dispatch, installation, and maintenance of transformers. Also No. 6, which deals with the methods employed in the drying out of oil transformers on site.

Messrs. Drake & Gorham Wholesale, Ltd., 67, Long Acre, W.C.2.—Pamphlet No. 335, giving details, prices, and numerous illustrations of ironclad switch- and fuse-gear, wall plugs, &c.

British Insulated and Helsby Cables, Ltd., Prescot, Lancs.—Catalogue No. P 172, containing well-illustrated descriptions of electricity meters, including several prepayment types.

The Electric Heating Co., George Street, Croydon.—March price list of "Elect" irons, kettles, and fires. Illustrated.

The Relay Automatic Telephone Co., Ltd., Marconi House, Strand, W.C.2.—A postcard illustrating an "R. A. T." 50-line switchboard and two examples of desk instruments.

X-Rays, Ltd., 11, Torrington Place, Gower Street, W.C.1.—An illustrated booklet dealing with deep X-ray therapy. Examples of apparatus for this purpose are shown and details and prices are given.

Messrs. Royles, Ltd., Irlam, near Manchester.—An illustrated and priced catalogue of condensers, feed-water heaters, calorifiers, steam kettles, air heaters, steam traps, &c.

Messrs. C. Isler & Co., of Bear Lane, Southwark Street, London, S.E.1, have sent us one of their wall sheet calendars for 1922, upon which there appears a number of interesting pictures of well-boring operations through London soil and in various other places at home and abroad.

Italian Trade Ship.—The King of Italy's yacht, "Trinacria," is to visit the Thames during the present summer. She has been lent to an Italian industrial federation for the display of Italian products in all parts of the world. Although not so suitable for the purpose as the British Trade Ship will be, says the *Evening News*, Southern buyers are attracted to the "Trinacria" by her former associations.

Electrification of Railways.—The question of the electrification of railways in the London area, a project involving an outlay of about £17,000,000, was before the Industrial group at a meeting at the House of Commons on February 20th. Sir William Pearce, M.P., was in the chair, and there were about 32 members of Parliament present representing trading communities and trading organisations. Sir William Forbes, of the Brighton Railway, and Mr. Tempest, of the South-Eastern Railway, also attended. After a long discussion on the proposals of the railways for electrification, a committee was appointed, consisting of Sir Alexander Richardson, Mr. A. M. Samuel, Mr. Frederick Wise, and Mr. P. J. Hannon, to examine the proposals, and to report at a further meeting of the group next Monday.—*Financial News.*

Book Notices.—"*Mechanical World* Electrical Pocket Book for 1922."—Manchester: Emmott & Co., Ltd. Price 2s. net.—The new features embodied in the latest edition of this useful publication include a lengthy section on "Power Station Construction and Operation," and another on "Electric Hoists" dealing with their construction and installation. The section on "Switchgear and Switchboards" has been rewritten and enlarged.

"Manuale per il Collaudo Macchine Elettriche," by Ing. G. Bianchi. Milan: Ulrico Hoeple. Price L.18.50.

"Electrical Engineering Testing," by G. D. Aspinall Parr. Fourth edition. Pp. xii+691; 296 figs. London: Chapman and Hall, Ltd. Price 16s. net.

"Science Abstracts" A & B. Vol. XXV, No. 289. Part 1, January 31st, 1922. London: E. & F. N. Spon, Ltd. Price 2s. 6d. each.

"Mechanical Testing," by R. G. Batson and J. H. Hyde. Vol. I. Testing of Materials of Construction. Pp. xiii+413, 258 figs. London: Chapman & Hall, Ltd. Price 21s. net.

Unemployment.—A further decrease in unemployment is shown in the Ministry of Labour returns for the week ending February 7th, when the total number of unemployed persons was 1,892,129, as compared with 1,905,933 in the previous week.

German Trade with Australia.—It is announced that the Commonwealth Government has finally decided to remove the embargo upon the importation of goods from ex-enemy nations as from August 1st. In the meantime the existing anti-dumping measures will be reinforced by further tariff legislation if this is found to be necessary. British and Australian goods will be protected from unfair competition.

Brazilian Tariffs.—Under a recent amendment of the Brazilian Customs tariff the import duty on static electric transformers cooled by oil, water or air is now as follows: weighing up to 200 kg., 600 reis per kg.; weighing over 200 and less than 400 kg., 400 reis per kg.; weighing more than 400 kg., 150 reis per kg.

Ediswan Social.—A social and dance, on a large scale, organised by the staff of the Edison Swan Electric Co., Ltd., and open to all the Ponders End Employés, was held at the works on February 11th, about 900 attending. The Girls' Dining Hall, a huge building capable of normally seating about 1,500, was cleared and transformed into a very creditable imitation of a Palais de Dance. The other entertainments provided were two concerts, one by Mr. A. P. Ambler's party, and the other by the Ediswan (Girls') Musical Society and Orchestra; a fine up-to-date kinema, which showed two splendid programmes; and numerous "side-shows."

Chinese Notes.—The Tung Eu Telephone Co. of Peking has been granted registration by the Ministry of Agriculture and Commerce.

The Yau Hua Electric Co., of Hsuchow, was established in 1905. Three new plants have been installed and a new building erected, which was completed on December 27th. It is estimated that the three plants supply 30,000 lights.

The merchants of Hokow, Yunnan, have raised $20,000 for the establishment of The Hokow Electricity Co., Ltd.

Wages and Conditions in the Tramway Industry.—A meeting of the National Industrial Council for the Tramways Industry was held in London on February 15th to consider the report of a special committee appointed to revise the National Agreement of 1919, with particular reference to the clauses relating to the guaranteed week. It was stated that while the undertakings generally were agreeable to the retention of the normal 48-hour week, they desired certain modifications in the terms of the guaranteed week. As agreement could not be reached, the Council decided to meet again on March 3rd. The Council has adopted a scale of wages and bonus for employés of various ages below 21 years.

On February 17th a national delegate conference of the tramway section of the Transport and General Workers' Union declared that it would not accept the employers' draft agreement even as a basis for discussion, and any attempt to enforce it would be met by "drastic action" to safeguard the principle laid down in the March, 1919, agreement.

A meeting of Scottish delegates resolved on the same day not to permit the application of the draft agreement to Scotland.

Meeting of Creditors.—Lawford, Ross & White, electrical engineers, 108, Woodlands Road, Glasgow.—Meeting of creditors to be held to-day (Friday) at the offices of James, Wilson & Gough, 135, Wellington Street, Glasgow.

Extended Payments for X-ray Equipment.—The difficulty encountered by numerous radiologists and hospitals in raising the necessary funds for the purchase of X-ray equipment has led X-Rays, Ltd., to institute a system of extended payments for its products. All such transactions are conducted with the strictest privacy; they are not handed over to a finance corporation, but are carried out by the firm itself. X-Rays, Ltd., also has a scheme of insurance of X-ray tubes.

Swiss Railway Electrification Contracts.—A special correspondent of *The Times Trade Supplement* at Geneva states that in the electrification of the St. Gothard line only Swiss firms were, for patriotic reasons, allowed to tender for the supply of cables. German offers, which were considerably cheaper, were rejected. "Now that new tenders are being invited, foreign firms will be allowed to compete. It appears that the Swiss electric cable makers labour under the disadvantage that there is no testing plant in the country for the size of cable in question. It would seem to be a good opportunity for English cable manufacturers to approach the Swiss Federal Railways, for Switzerland is preparing the electrification of a network of 3,000 miles, of which 1,800 miles are lines bearing fast traffic. In the National Parliament a Deputy from Basel recently asked the Government to study the question whether it will really pay the Federal Railways to electrify branch lines, particularly in view of the fall in the price of coal. The cables and overhead equipment are expensive, and there are many branch lines in the country with only six or eight trains daily. The matter is now being investigated, and the decision will influence Switzerland's future position in the international coal market."

An Illumination Calculating Chart.—The Edison Swan Electric Co., Ltd., has issued a chart by means of which the number of lamps required to give a certain intensity of illumination for various areas may be calculated. The watt-lumen value of vacuum and gasfilled lamps of different sizes and voltages is given in a table.

Locomotives for French Railways.—A correction has now been issued in Paris of the report alleging that the French State Railway authorities had placed an order with a Swedish company for the delivery of 30 electric locomotives. It is now said that the contract has been awarded to the Société Fives-Lille, which proposes to use motors of a Swedish type, for which the company holds a licence, and to construct them in France.

German Competition in France.—One of the directors of a company in Paris is reported to have stated that the latter recently invited tenders from French, Swiss, and German firms for the supply of certain electrical machines. The two former quoted a price of 670,000 French francs, and the latter, which received the order, tendered at 175,000 fr.

A New Showroom.—Messrs. Troughton & Young, electrical contractors, have recently opened, as a new branch of their business, a new demonstration showroom at 143, Knightsbridge, S.W.1. The situation is an excellent one, being upon the dividing line between the West End and the south-western residential area. A large double window is dressed to attract the passer-by. In one side a washing machine is shown in motion and upon the other side appears a collection of cakes and pastry cooked electrically in the showroom. Each branch of electricity's usefulness is well demonstrated. The firm's policy with regard to electric cooking, washing and cleaning is to select the appliances, in each case, which, in the firm's opinion, are the best of their kind, instead of a large collection of various makes. We are informed that the selection has been made after careful comparison by experienced men, special regard having been paid to reliability, efficiency, and cheapness. The lighting fittings are varied, as are also the smaller devices shown. While the showroom is to be a permanent one, the demonstration side is temporary, although prospective purchasers will always be enabled to examine appliances in operation by arrangement.

Messrs. Troughton & Young wish, by their example, to rouse other electrical contractors to the necessity for employing this means of popularising the use of electricity, and also to show that they realise that the contractors' activities should not be confined to installation and mere agency work.

For Sale.—By direction of the Disposal Board, Messrs. Hall, Wateridge & Owen, Ltd., will sell by auction on March 8th and 9th, at Monkmoor Aerodrome, near Shrewsbury, machinery, plant, electrical equipment, stores, &c.

Aldershot Urban District Council electricity department invite offers for two new Babcock type superheaters complete, two Willans-Parker 80-kW steam sets, and one 135-kW Carels-Peebles Diesel set.

By direction of the Disposal Board, Messrs. Eadon and Lockwood will sell by auction at H.M. Factory, Langwith, Derbyshire, on March 14th to 17th, electrical power plant, machinery, stores, &c. (See our advertisement pages to-day.)

Export Credits.—The Export Credit Department reports that up to December 31st, 1921, it had sanctioned £3,066,780 in advances, of which £1,412,210 had been taken up and £45,395 repaid. Guarantees to a total of £1,976,884 had been sanctioned and £258,537 had been taken up. Credits sanctioned amounted to £1,016,000 and £7,929 had been taken up.

The Johannesburg Strike.—Although no agreement has been reached between the employers and miners on the Rand, it is reported that the men are returning to work in large numbers, and in some cases the mines have their full complement. The Government has announced its intention of setting up an impartial board to investigate and report upon the whole matter.

Birmingham Efficiency Exhibition.—We have received a prospectus of the Industrial and Commercial Efficiency Exhibition which is to be held at Birmingham from May 25th to June 3rd. The many subjects represented will include smoke abatement, roads and transport, fuel conservation, works management, welfare work, publicity and sales, &c. The exhibition, which is to be held at Bingley Hall, is being organised by the Birmingham Chamber of Commerce.

Swiss Operations in Poland.—Under the title of "Polish Electrical Undertakings Brown-Boveri Companies," a new joint-stock company has been formed to take over the Warsaw branch of the Swiss firm, Brown, Boveri et Cie. The principal aim of this undertaking is the manufacture of dynamos and other electrical machinery in Poland. For this purpose the company has acquired large estates in the vicinity of Warsaw.—*Manchester Guardian Commercial.*

New French Company.—The Société Centrale de Distribution d'Energie is the style of a company launched by the Electrification Industrielle and the Société Commerciale du Verre to undertake the acquisition and working of electric lighting and motive power concessions. The new company's capital is 100,000 fr., and its offices are at 12, Boulevard du Temple, Paris.

Engineering Unemployment.—Unemployment among the members of the Amalgamated Engineering Union remains at a serious level—22 per cent. of the membership—in spite of small decreases. The *Manchester Guardian* states that no less than £2,162,387 was paid out to unemployed members during the latter half of 1921. The Council of the A.E.U. points out the benefit to the nation secured by this co-operation of the men themselves.

Tramway Undertakings and the Penny Fare.—The Municipal Tramways Association is of the opinion that the heavy losses incurred by the L.C.C. and other authorities owning tramway systems are due to the restoration of penny fares. It is recognised that the 1½d. fare is unattractive to the public, and the Association has therefore declared itself in favour of the decimalisation of the shilling, the penny becoming a tenth part. It is considered that such a coin would be willingly paid by passengers.

The Wimbledon Case.—In response to a petition from a large number of burgesses asking that a town's meeting be called to consider the dismissal of Mr. Tomlinson Lee from the post of Borough Electrical Engineer, the Mayor of Wimbledon states that the Council represents the people and conducts their business, and if ratepayers are not satisfied with the Council they can refuse to re-elect the members at the next opportunity; he thinks the calling of a town's meeting could bring forth no useful results.

Workmen's Compensation Acts.—Inquiries received at the Home Office indicate that considerable uncertainty exists among employers and workmen as to the duration of the Workmen's Compensation (War Addition) Acts, 1917 and 1919, and the Home Secretary points out that these Acts (which were originally due to expire six months after the end of the war) have been continued in force by the Expiring Laws Continuance Act, 1921, until December 31st, 1922.—*The Times.*

Women's Wages in Government Engineering Works.—The Industrial Court issued its award on Saturday, granting an application by the official side of the Engineering Trade Joint Council for the reduction of the wages of women employed by the War Department in engineering establishments by 2s. 6d. per week. The total number of women concerned is just over 300. The present rate in the Woolwich and Enfield establishments is 35s. 6d. per week, and at Farnborough 34s. 6d. per week. The reductions will come into force next pay day. A claim by wiremen in the Admiralty dockyards for an increase of 2s. per week in the rates was allowed by the Court.—*Manchester Guardian.*

Steel Works to Close.—According to daily Press reports, an official announcement has been issued by Sir W. G. Armstrong, Whitworth & Co., Ltd., stating that owing to the high cost of production, they are closing down the steel works, forge and stamping department. Between 800 and 900 men will be dismissed. The department will be reopened when sufficient orders at remunerative prices are secured.

The "Priestman" Scheme.—At the annual meeting of the Higher Production Council, which was formed to make known the system of "Collective bonus on output," introduced by Messrs. Priestman's, Ltd., it was stated that 24 businesses had adopted the scheme, 17 had introduced modifications of it; 40 other schemes—although not quite on the same lines—have also resulted from a study of this scheme. The Higher Production Council was formed to discover "some method of satisfying the wish of those who felt that industries should be so conducted as to give the workmen employed in them a share in the profits in addition to their wages, and some voice in the control of the conditions under which they worked."—*Co-partnership.*

The British Industries Fair.—The secretary of the Fair informs us that most of the railway companies are running special excursions to London for visitors to the Fair, in addition to their usual excursions, from a number of provincial towns. Particulars can be obtained from the railway offices.

LIGHTING AND POWER NOTES.

Aylesbury.—Loan.—Application has been made by the Town Council for sanction to a loan of £7,400 for meters and for the wiring of houses.

Barrow-in-Furness.—Extension of Supply.—As a result of the discontinuance of gas supply to the districts of Rampside and Roa Island, by the Furness Railway Co., the Barrow Borough Electrical Engineer has been asked to have a canvass taken of the residents of the districts with a view to ascertaining the number prepared to take electricity, and the amount they are prepared to guarantee, in order that electricity may be supplied to the districts. He has also been instructed to visit the Furness Railway Co. and to submit a report and estimate of the cost of the scheme.

Bradford.—New Plant.—The Advisory Sub-Committee has recommended that in order to cope with the anticipated demand for electricity next winter, two converters of 1,500 kW each be installed at the main generating station, and that application be made to the Electricity Commissioners for sanction to borrow the necessary amount to cover the cost.

Canada.—Water Power Scheme.—Work has commenced on the harnessing of the Skagit river, which, when completed, will generate electricity for the City of Seattle. A tunnel, 2½ miles in length, is being constructed, through which the Upper Skagit river will be diverted during the building of a large dam, when the tunnel will be used as a penstock in which turbo-alternators will be installed. The work, which will not be completed before next winter, will provide employment for 500 men.

Cardiff.—New Plant.—In order to meet the increased demands for electricity, the City Council is installing three new boilers, complete with accessories, at an estimated cost of £59,300.

Clown (Chesterfield).—Electricity Supply.—The Rural District Council is applying to the Bolsover Colliery Co., and the Shirrcates Colliery Co., for a supply of electricity to the district.

Continental.—Norway.—The *Norges Handelstidende* recently published a review of the State hydro-electric developments. The first works to be constructed by the Government was that at Hakavik, which will be partly completed this year. The initial plant at Hakavik will comprise four 5,000-h.p. turbines driving 2,700-kW single-phase generators producing current at 3,500 V, 15-16⅔ cycles. The pressure will be raised to 66,000 V, and the power will be taken a distance of 31 miles to Asker, from whence it will be distributed. The Glomfjord works, commenced in 1912 and sold to the State in 1918, has at present two large sets supplying 22,000 kW of 25-cycle energy continuously. A contract was made with the Glomfjord Smelting Works Co. whereby this company agreed to take surplus power from the works. As the company was compelled to shut down a year ago, the State has incurred a deficit on this undertaking. The station is designed for six sets of from 25,000 to 27,500 turbine h.p., and the Government is faced with the task of finding a market for this power. A further State works is the Morkfos station, where it is proposed to install 13 sets with an aggregate of about 160,000 turbine h.p. The first section, which is expected to be completed by 1924, will comprise six sets developing 60,000 h.p.

Belgium.—La Société de l'Electricité du Nord de la Belgique has just decided on an increase of capital in order to extend its operations. Although the area covered embraces a portion of the Provinces of Antwerp, Brabant and Western Flanders the company is only supplying power to 67 towns and villages, and has only 24,000 clients for lighting or but 6 per cent. of the population. In connection with the developments, a new high-pressure line has just been established between Malines and Louvain.

Douglas (I. of M.).—Electricity Charges.—The Electricity Committee has adopted the two-rate system of payment, a smaller charge being made during the day-time, so as to encourage the use of electricity for power and other purposes. The committee has not yet considered the question of wiring private dwellings.

Grampian Scheme.—The Chairmen of Committees of both Houses of Parliament have decided that the Grampian Electricity Order and West Scottish Railways Group Order shall be proceeded with as private Bills. Other private legislation, including the Aberdeen Corporation Order, is to be dealt with as Provisional Orders.

Harpenden.—Electricity Supply.—The Urban Council has referred to a committee the question of a supply of electricity. At a meeting of the Council, on February 13th, the Clerk reported that negotiations between Luton Corporation and the North Metropolitan Co. for providing a supply were making good progress, and he advised the Council to give its consent to the supply of power in Harpenden.

Hereford.—Loan.—The City Council is applying to the Electricity Commissioners for sanction to the borrowing of £1,722 for mains and services.

Hull.—Sub-Committee's Report.—The sub-committee of the Electricity Committee, appointed to investigate and report upon the undertaking, has presented an interim report. The unsatisfactory financial position is due, it states, to the high cost of production, the cost of coal, wages, repairs, and maintenance being excessive; to the exhaustion of the reserve for capital expenditure; to the failure of the committee to create a special reserve for deferred war-time repairs; to the failure of the committee to increase charges to keep pace with the cost of production; and to the under-estimation of the capital cost of new plant. As regards the technical defects, the engineer reports that the new water-tube boilers need economisers; the mechanical stokers are not efficient; and the shafts and chimneys are inadequate. As there is some disagreement upon these points, the services of an independent consultant should be secured. A lack of discipline is reported; this is due in a large measure to differences between the engineer and his chief assistant. It is the sub-Committee's opinion that the two officers cannot remain in their present positions, and the chief assistant, Mr. Mageris, being junior, should go; and also that the chairman and Major Bell (the chief engineer) cannot both remain in their present positions. The dismissal of an employé is also recommended. In addition to the appointment of a consultant, it is also suggested that short visits be paid by a deputation to successfully-worked undertakings to study their systems. The Electricity Committee is recommended to resign, and a new committee, consisting of ten persons only, is suggested. We learn that at a meeting of the Council to consider the report, the chairman of the Electricity Committee tendered his resignation. The Committee itself is remaining in office.

Inverurie.—Electricity Supply.—A scheme is under consideration for the supply of electricity to the town from Aberdeen, and Mr. J. E. Sayers, electrical engineer, Glasgow, has been instructed to forward an estimate as to the cost of a supply of electricity to the town.

Kilkee (Co. Clare).—Electricity Supply.—A committee has been appointed to consider the question of a supply of electricity to the town.

Kirkcaldy.—Loan.—The Town Council has decided to borrow £210,400 for electricity purposes.

Lancing.—Electricity Supply.—The Parish Council has instructed the Clerk to obtain particulars from the Shoreham and District Electric Lighting & Power Co. regarding the supply of electricity to the district.

London.—Stepney.—The L.C.C. is recommended to oppose the Borough Council's application for an Order conferring certain powers regarding electricity supply upon it. The clause objected to is one which exempts the Borough Council in certain circumstances from proceedings for nuisance caused by smoke from a proposed new generating station at Limehouse, in the neighbourhood of two L.C.C. schools.

Hammersmith.—The Electricity Committee recommends the institution of a "restricted hours" system of electricity supply. Consumers agreeing to pay a rental for a special time switch and the cost of wiring, and having an installation of not less than 6 kW, would be supplied at a flat rate of 1d. per kWh during "off-peak" hours.

St. Pancras.—Application is to be made to the L.C.C. for loans of £46,669 and £40,000 for additional plant at the power station and for mains, services, &c. The Council has already received the sanction of the Electricity Commissioners to borrow these amounts.

Mid-Glamorgan.—Joint Electricity Scheme.—A conference, at which the Maesteg, Ogmore and Garw Councils were represented, has recently been held to formulate a joint scheme for obtaining electricity for lighting purposes. It is hoped that combination will ensure a cheaper supply than independent action. Negotiations have been entered into with the South Wales Power Co. and Mr. Arthur Ellis has submitted a report on the projected undertaking to the conference. The joint committee has decided to recommend to its respective Councils "That the principle of a joint scheme for electric supply to the Ogmore, Garw and Maesteg Councils' urban areas be agreed upon, subject to further report from the electrical expert."

Neath.—Loan.—Application is being made to the Electricity Commissioners for sanction to borrow £20,000 for the installation of new generating plant.

Pontypridd.—Extensions.—The District Council has under consideration a proposal for the installation of a transformer at an estimated cost of £3,000. Owing to the increased demand for electricity, the Council has contracted for a supplementary supply from the Treforest Consumers' Co.

Price Reductions.—Charges for electricity have been reduced in the following districts: Darlington, Doncaster, Huddersfield, Taunton, and Wakefield.

Rickmansworth.—Extension of Time.—The Electricity Commissioners have granted one year's extension, from July 31st, 1921, for carrying out the Rickmansworth and Chorleywood Electric Lighting Order. The Colne Valley Electricity Supply Co., Ltd., is arranging for a supply of electricity in bulk from the Northwood Electric Light and Power Co.

Runcorn.—New Sub-Station.—The Town Council has approved of plans for a new electricity sub-station to be erected at Latchford Without.

Tilbury.—Proposed New Power Station.—The Urban Council has renewed an application to the Port of London Authority for the provision of a refuse destructor and electricity generating station at the docks, from which electricity can be obtained in bulk at a cheap rate. The Council has also instructed the Surveyor to go into the question.

Walsall.—Loan Sanctioned.—The Electric Supply Committee has received the sanction of the Electricity Commissioners to the borrowing of £3,070 for extensions to mains in various parts of the town.

Westgate.—Extension of Time.—The Electricity Commissioners have informed the Parish Council that the Westgate and Birchington Gas and Electricity Co. has been granted an extension of 15 months, to May 26th, 1922, for the completion of the electricity works.

Wellingborough.—Revocation of Order.—The Minister of Transport has revoked the Wellingborough (Public Purposes) Electric Lighting Order, 1901, as from February 14th, 1922.

TRAMWAY AND RAILWAY NOTES.

Argentina.—Railway Electrification.—The Buenos Aires correspondent of the *Financial Times*, in a review of the situation of the Argentine railways, states that the money recently raised by the Western Railway Co. will be utilised for carrying out the electrification of the Buenos Aires suburban lines. The company's line from the port to its goods terminus, a distance of five miles, is also down for early electrification. Another projected electrification is that of the Great Southern loop to La Plata.

Blackpool.—Track Renewal.—The Electricity and Tramways Committee has decided to relay the tramway track on the promenade from Talbot Square to Wellington Road, the rails to be laid on sleepers instead of on concrete. The estimated cost of this work is £16,000.

Canada.—Railway Electrification.—In connection with the scheme for harnessing the Skagit river, it is intended to construct about 100 miles of electric railway in and around Seattle. Work on the erection of transmission lines has already commenced.

Continental.—France.—The shareholders in the Chemin de Fer Metropolitain de Paris have authorised the directors to issue loans up to 250,000,000 fr. for works which had to be suspended during the war.

Norway.—The Commercial Secretary to H.M. Legation at Christiania reports that, according to the local press, it is proposed to commence immediately preliminary work on the two electric railways for which concessions have been granted to A/S "Akersbanerne." The Ostensjo line, which is to cover a distance of 5.2 km., is calculated to cost kr. 720,000 per km., while the estimated cost of the Sognsvand line is kr. 700,000 per km.

Dover.—Railless Traction.—Application is being made by the Corporation for power to run railless trolley vehicles on certain routes not already covered by electric tramways.

L. B. & S. C. Railway.—Electrification.—Mr. Macrae, chairman of the company, speaking at the recent annual meeting, said that there was a serious falling off in the traffic due to the competition of tramways and other road transport systems. This could only be met by electrifying the suburban lines. The scheme had been fully worked out and the company was ready to place contracts immediately agreement among the members of the Southern railway group had been reached. Mr. Macrae considered that the Railway Act would have to be considerably modified. In reply to a question, the chairman said that the present cost of the scheme would be about £10,000,000, as compared with £7,000,000 in 1913.

Pontypridd.—Fares Agreement.—Application is being made to the Rhondda Council for a reciprocal agreement of reduction in tramway fares on their respective systems from the point where they meet.

West Hartlepool.—Railless Traction.—The Corporation has under consideration a proposal for the introduction of a railless trolley system on certain routes in the town.

TELEGRAPH AND TELEPHONE NOTES.

Ireland.—New Cable Base.—The Commercial Cable Co. applied, on February 16th, to the Cork Harbour Commissioners for permission to establish a cable base at Queenstown, where a cable ship with a crew of 65 would be permanently stationed for repairs to the company's Atlantic cable. The application was granted, subject to legal formalities.—*The Times.*

Russia.—New Wireless Station.—A new wireless telegraph station, built entirely by Russian workers, is nearing completion at Detskoje Selo, says the *Westminster Gazette.*

The Telegraph Service.—Cable Rates.—The rates of charge and routes for telegrams to Libya (Africa), Canada, the Persian Gulf, Venezuela, and the Willis Islets are set out in the *London Gazette* (February 17th), from which it appears that when messages are sent by the Marconi Co. there is a slight saving in cost.

The Telephone Service.—Committee Reappointed.—The House of Commons, on February 17th, reappointed the Select Committee to inquire into the organisation and administration of the telephone service and the methods of making charges.

Subscribers.—The Postmaster-General informed the House of Commons recently that the number of telephone subscribers who had discontinued the service since the increased charges were imposed was 61,500, and the number of extensions surrendered was 55,000. More than half of those were due to normal causes. The number of new subscribers connected during the same period was 67,300, and the number of extensions fitted, 60,000. The net gain to the revenue was about £158,000.—*Daily Telegraph.*

United States.—Naval Wireless.—The Senate on February 20th passed the resolution, already adopted by the House of Representatives, which extends the privileges of the naval wireless telegraph service to the Press for five years.—*Westminster Gazette.*

Wireless Telegraphy.—London Service.—The growing demand made upon the high-speed wireless services to France and elsewhere has necessitated the provision of increased facilities, and a new telegraph office was opened by Marconi's Wireless Telegraph Co., Ltd., at Radio House, 2-12, Wilson Street, E.C.2, on February 19th. This will be the principal office for the receipt of Marconigrams, will be the company's traffic headquarters, is in direct communication with all the Marconi wireless stations, and also with the Marconi telegraph offices at Marconi House, Fenchurch Street, and the Baltic Exchange. Professional and business men are renting private telegraph and telephone lines to put them in direct touch with Radio House. This arrangement is particularly advantageous to those having business with France, because Paris messages will be sent automatically and at high speed direct from the transmitter at Radio House without any intermediate handling.

Hebrides Service.—The telegraph cable connecting the Outer Hebrides with the mainland having been interrupted during recent storms, a temporary wireless service has been established between the wireless stations at Tobermory, Mull, and Loch Boisdale, South Uist, which are maintained for use in cases of emergency. The telegraph traffic with Stornoway, which is the centre of the fishing industry in the Outer Hebrides, is exceptionally heavy during the fishing season, but since the inauguration of the wireless service the whole of the traffic has been disposed of without delay. Post Office wireless stations are also available for use in the event of cable difficulties at Guernsey and Lerwick for communication with corresponding stations on the mainland.

An Imperial Link.—Wireless communication has been established between the Imperial Wireless Chain station near Cairo and the Leafield station in Oxfordshire. For some time previously Cairo had been receiving messages over the 2,200-mile circuit from England, but tests in the dispatch of messages from Egypt have only just commenced, says the *Daily News.*

The number of wireless licences issued to amateurs for experiments in reception is 6,086, and in transmission 286. —*The Times.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—April 29th. Electricity Commission. 22,000-V, three-core cable and accessories for the Morwell power scheme. (See this issue.)

Belfast.—February 28th. Tramways Committee. Six or 12 months' supply of tramway stores, including electrical accessories, cable, lamps, &c. (February 10th.)

Belgium.—April 11th. Municipal authorities of Dinant. Concession for the supply of electricity for lighting and power purposes in the town. Specification (10 fr.) from the Maison Communale, Dinant.

Ghent.—March 11th. Municipal Council. Four self-propelling electrical cranes and two floating steam cranes.*

Blackpool.—March 16th. Electricity Committee. H.p. switchgear and switch-room equipment for power house and sub-stations. H.p. underground armoured three-core transmission cables. (See this issue.)

Bristol.—March 17th. Docks Committee. Four 30-cwt. movable electric jib cranes. Mr. T. A. Peace, engineer, Bristol Docks Committee, Avonmouth Docks.

*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

Dundee.—February 27th. Electricity Department. Five sets of converting machinery. Mr. H. Richardson, general manager and engineer.

Edinburgh.—March 20th. Electricity Department Auxiliary plant and pipework (Spec. No. 41). (February 17th.)

Glamorgan.—March 4th. County Council. Installation of electric light (Henley system) at Bridgend police station and court, Cilfnydd police station and Llanharan police station. Mr. W. E. R. Allen, deputy clerk, Glamorgan County Hall, Cardiff.

India.—Calcutta.—March 20th. Municipal Council. Eight electric lorries and motor-generator charging sets. Particulars from chief engineer to the Corporation.—*Reuter's Trade Service* (Calcutta).

Leeds.—February 27th. Tramways and Highways Committee. Twelve months' supply of electrical sundries. Mr. J. B. Hamilton, general and commercial manager, 1, Swinegate, Leeds.

Liverpool.—February 27th. Board of Guardians. Overhead electrical installation, Olive Mount Institutions, Wavertree. G. W. Coster, Parish Offices, Liverpool.

London.—Metropolitan Asylums Board.—March 1st. Installation of electric lighting and power, telephones, and fire alarms; and continuous drying machine, for the Eastern Fever Extension Hospital, Homerton. (February 17th.)

St. Pancras.—March 7th. Electricity Department. E.h.p. 3-ph. switchgear for two sub-stations. (See this issue.)

Bermondsey.—March 9th. Board of Guardians. Six months' supply of electric lamps. Mr. H. H. Cleeve, clerk to the Guardians.

Hammersmith.—March 3rd. Electricity Department. One 20-ton weighbridge for the Electricity Department. (See this issue.)

Portsmouth. — Electricity Department. Economisers, steam pumps and circulating pumps. (February 17th.)

Rhondda.—April 3rd. Electricity Department. Supply of house service a.c. meters, cable, joint boxes, compound, cut-outs, &c., for 12 months. (See this issue.)

Stockton-on-Tees.—February 28th. Electricity Committee. E.h.p., l.p., and pilot cables. (February 17th.)

Wigan.—March 13th. Electricity Department. Steam turbine, 5,000 kW, 3-ph. alternator and exciter, and surface condensing plant. (February 17th.)

CLOSED.

Aylesbury.—Town Council. Accepted:—
Cables (£295).—Hackbridge Cable Co., Ltd.
Transformer (£168).—British Electrical Transformer Co., Ltd.
Transformer plant (£2,739).—General Electric Co.

Belgium.—Six firms submitted tenders last week to the municipal authorities of Ixelles, Brussels, for the supply of electricity meters. The lowest offer was that of M. G. Bornheim, of Brussels; the prices quoted ranged from 57.50 fr. to 237.50 fr. per meter.

Belgian State Railways.—Several foreign firms competed last week for the supply of 1,200 metres of conductor cables and 8,000 metres of flexible forged copper cable (ten offers were received), the lowest being that of the Pressburg Cable Works, of Pressburg, Czecho-Slovakia. For the supply of 80,500 white enamelled porcelain insulators, the lowest offer (112,440 fr.) was that of the Société Electrique et Mécanique, of Brussels.

Bradford.—Electricity Committee.
Converting sets.—Bruce Peebles & Co., Ltd.

Tramways Committee.
Portable air compressor.—Consolidated Pneumatic Tool Co.
20 tons cast-iron track brake blocks.—Cole, Marchent & Morley, Ltd.
Iron castings, at 34s. per cwt.—H. Summersgill.
1,000 66-in. copper rail bonds, at 3s. 7½d. each.—British Insulated and Helsby Cables, Ltd.

Canada.—The Canadian Government has placed a contract for an automatic telephone exchange (6,000 lines) with Messrs. Siemens Bros. & Co., Ltd.

Liverpool.—Board of Guardians. Accepted:—
Electrical installation (£21,000).—Electrical Contracting & Motor Co., Castleford.

London.—L.C.C.—Main Drainage Committee. Storm-water pumping machinery at Hammersmith pumping station:

	Five sets.	Four sets.	Three sets.
	£	£	£
Gwynne's Eng. Co., Ltd.	**58,473**	50,564	43,079
Campbell Gas Engine Co., Ltd.	68,595	58,755	48,995
Ditto alternative (gas engines) ...	74,970	63,855	52,820
Ditto alternative (oil engines) ...	80,920	68,665	56,484
National Gas Engine Co., Ltd.	82,567	69,247	55,412
Hick, Hargreaves & Co., Ltd.	89,758	74,233	58,552
English Electric Co., Ltd.	89,965	74,812	59,620
Vickers, Ltd.	115,817	98,600	79,100
John Cochrane (Barrhead), Ltd. (incomplete)	17,180	14,800	12,420

The Committee has accepted the tender of Gwynne's Eng. Co., Ltd., for five sets of machinery, subject to certain alterations, at an additional cost of £987, and has decided to allow the company to sublet the main and auxiliary engines to the Premier Gas Engine Co., Ltd., and other items included in the contract to such persons or firms as the chief engineer may approve.

FORTHCOMING EVENTS.

Manchester Wireless Society.—Saturday, February 25th. At the Albion Hotel, Piccadilly, Manchester. At 7.30 p.m. Smoking concert.

Association of Engineers-in-Charge.—Saturday, February 25th. At St. Bride's Institute, Bride Lane, E.C. At 7.30 p.m. Informal discussion on "Mechanical Stokers v. Hand Firing, both with Forced Draught."

Royal Society of Arts.—Monday, February 27th. At John Street, Adelphi. At 8 p.m. Cantor lecture (II.), "The Mechanical Design of Scientific Instruments," by Prof. A. F. C. Pollard.

Electrical Contractors' Association.—Monday, February 27th. At the Hotel Cecil, Strand, W.C. At 7 p.m. Dinner to commemorate 21st anniversary.

British Industries Fair.—February 27th to March 10th. At the White City, Shepherd's Bush, W., and at the Castle Bromwich Aerodrome, Birmingham.

Illuminating Engineering Society.—Tuesday, February 28th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Discussion on "Industrial Lighting: Ideal Requirements (legislative and otherwise) and Practical Solutions," to be opened by Mr. L. Gaster.

Northampton Engineering College Engineering Society.—Wednesday, March 1st. At the Northampton Institute, St. John Street, E.C.1. Paper on "Photo Elasticity," by Prof. E. G. Coker, F.R.S.

Ideal Home Exhibition.—March 1st to 25th. At Olympia, W.

Electricity Supply Commercial Association.—Wednesday, March 1st. At Anderton's Hotel, Fleet Street, E.C. At 7.45 p.m. Second Bohemian concert.

Industrial League and Council.—Wednesday, March 1st. At Caxton Hall, S.W. At 7.30 p.m. Lecture on "The Purpose of Economic Activities," by Mr. H. Cousens.

Institution of Electrical Engineers.—Thursday, March 2nd. At the Institution, Victoria Embankment, W.C. At 6 p.m. Discussion on "Starters," with introductory papers by:—Mr. C. H. Wordingham, on "The B.E.S.A. Specifications for Starters"; by Mr. J. Anderson, on "Electric Motor Starters"; and Mr. W. Wilson, on "Some Notes on the Design of Liquid Rheostats."

(Informal Meeting)—Monday, February 27th. At the Engineers' Club. Third annual smoking concert.

(Wireless Section).—Wednesday, March 1st. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "The Thermionic Triode as Rectifier," by Messrs. E. B. Moullen and L. B. Turner.

(North-Eastern Centre).—Monday, February 27th. At the Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Discussion on "Starters."

(North-Midland Centre).—Tuesday, February 28th. At the Hotel Metropole, Leeds. At 7 p.m. Exhibition of Kinematograph Films, by Dr. C. C. Garrard and Mr. F. Gill.

(Scottish Centre).—Tuesday, February 28th. At the Grosvenor Restaurant, Glasgow. Annual dinner.

(North-Western Students' Centre).—Tuesday, February 28th. At Houldsworth Hall, Deansgate, Manchester. At 7.30 p.m. Paper on "The Application of X-rays to the Engineering Industry," by Mr. A. F. Steel.

(Tees-side Sub-Centre).—Thursday, March 2nd. At the Cleveland Technical Institute, Middlesbrough. At 7 p.m. Exhibition of Kinematograph Films.

Chelmsford Engineering Society.—Thursday, March 2nd. At the East Anglian Institute of Agriculture. At 7 p.m. Students' meeting.

Chemical Society.—Thursday, March 2nd. At Burlington House, Piccadilly, W. At 8 p.m. Ordinary meeting.

Junior Institution of Engineers.—Friday, March 3rd. At Caxton Hall, S.W. At 8 p.m. Lecturette, "Factory Administration," by Mr. T. Elbourne.

Royal Institution.—Saturday, March 4th. At Albemarle Street, W. At 3 p.m. First of a course of six lectures on "Radio-activity," by Sir Ernest Rutherford.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week, we need the names of:—

Importers of natural-coloured glass carbon-filament lamps.

Firms who strip (not burn) light or heavy steel armoured and cab-tire sheathed cable.

Suppliers of a carbon-filament lamp with two filaments, one of 16 c.p. and one of 2 c.p., with an attachment so that either can be used at will.

Makers of Coraline soldering paste.

Makers of aluminium alternating-current rectifiers.

NOTES.

Industrial Fatigue Research Board.—The second annual report (to September 30th, 1921) of the Industrial Fatigue Research Board has now been published (H.M. Stationery Office. Price 1s. 6d. net). In the introduction the Board states that it recognises that a great deal of the research work carried out by it should be done by the industries themselves, but it considers that any widespread response is not to be expected at the present time. The Board was strengthened on its engineering side by the appointment of Sir Joseph Petavel, K.B.E., F.R.S., Director of the N.P.L., and Mr. A. P. M. Fleming, C.B.E., of the Metropolitan-Vickers Electrical Co., Ltd. Sir Charles Sherington, G.B.E., was forced to resign the position of chairman owing to the pressure of his duties as President of the Royal Society. The investigations made by the Board entered into several industries, and covered a variety of subjects, such as the causes of variation in output; the study of the factors in accidents, sickness, and mortality; the effect of organised rest pauses; the relation of hours of work to production, comparing shifts of different length; the effects of temperature, humidity, lighting, and other conditions upon employés; and vocational selection and guidance. A bibliography of previous reports of the Board and other authorities is given as an appendix.

(*Continued on p. 273.*)

THE JUBILEE OF THE INSTITUTION OF ELECTRICAL ENGINEERS.—II.

When the reader sees these words, the commemoration meetings of the Institution will have passed into history. In our last issue we reproduced portraits of men who were members when it was still known as the Society of Telegraph Engineers—when its roll of membership comprised barely as many hundreds as it now embraces thousands; to-day we devote our space to the Institution as it now exists, and give portraits of some of the present officials and members.

The President, Mr. John Somerville Highfield, M.Inst.C.E., has so recently been the subject of a biographical article in our pages* that our readers will not expect us again to give details of his career; suffice it to say that, the son of an engineer, he has been an engineer from boyhood, to say nothing of his attainments as an enthusiastic yachtsman. He enjoyed the inestimable privilege of being a pupil and assistant of Dr. John Hopkinson, and used his knowledge of the principles of dynamo-electric machinery to excellent purpose quite early in his career. As engineer to the Metropolitan Electric Supply Co. he has exercised profound influence upon the development of electricity supply in and around London, and in a similar capacity he secured for the Cornwall Electric Power Company exceptionally favourable conditions. His long service on the Council of the Institution qualified him to take up the reins of government with a sure hand, and the success of his tenure of office as President, never in doubt, has already been abundantly realised.

The success of an Institution such as that of which we write depends very largely upon the chief of the permanent staff; presidents come and go, and Councils gradually change their character and personnel, but the Secretary, if he does not go on like the brook "for ever," at least remains in office for many years and exercises a powerful influence upon the development of the Institution and the trend of its policy. The Institution of Electrical Engineers has been singularly fortunate in its secretaries; in particular we may mention Mr. F. H. Webb, beloved of all, and Mr. W. G. McMillan, whose devotion to the interests of the body which he served in all probability was contributory to his untimely death. In Mr. Percy F. Rowell these excellent officers have a worthy successor, who has now occupied the secretarial chair for thirteen years, and in that capacity has secured the esteem and confidence of the whole body of members, whilst he has conferred upon the extensive organisation of the Institution, both at headquarters and at the Territorial Centres, an efficiency and competency which compel admiration. Mr. Rowell was educated at the Royal College of Mauritius and at King's College, London; he joined the staff of the Institution in 1901, became assistant secretary in 1904, and was appointed secretary, and editor of the *Journal*, in 1909.

Probably few members realise how extremely onerous are the duties of the president, the secretary, and the staff; but if they will take the trouble to read the report of the Council for the year 1920-21, they will find, first, that the membership since 1918 has increased at the rate of approximately 1,000 a year, being now over 10,000; that the annual income of the Institution was then over £33,000, and the assets over £100,000; that there were 20 standing and sectional committees, six special committees, and 33 bodies on which the Institution was represented, besides seven Territorial Centres, six Sub-Centres, and five Students' Sections, the number of meetings held during the year being no fewer than 331; and that in addition there were extra duties in connection with the reconditioning of the Institution, the War Memorial, the Royal Charter, and numerous other matters—not least of which, in the current year, has been the organisation of the commemoration meetings. It will be seen that an immense amount of work falls to the lot of the secretary, Mr. Rowell, the chief clerk, Mr. R. H. Tree, and the rest of the headquarters staff. Fortunately their long exile from the house of the Institution reached its conclusion in May last year, and the whole of the admirable amenities of the building, including the finest electrical library in Europe, are now available to the members, while many kindred societies enjoy the hospitality of the Institution from time to time.

An account of the career of Dr. Fleming is given in connection with his lecture on another page.

Col. R. E. B. Crompton, C.B., M.Inst.C.E., who delivered the first of the discourses on Wednesday, was born in 1845, married in the year when the Society was formed, and is still hale and hearty and frequently a speaker at the Institution meetings; but as he spent the years from 1863 to 1876 in the British Army, serving most of the time in India, he was not a founder member. In 1878 he commenced the manufacture of dynamos and arc lamps, and a few years later he carried out the first big installation of Swan incandescent lamps (at the Law Courts). From 1884 to 1887 he was engaged in developing a public electricity supply system at Vienna, where he originated many features of power station design which afterwards became standard practice, and in 1886 he started electricity supply in Kensington, with immediate success. Whilst Col. Crompton has made his mark in many other fields—notably in road traction—his greatest achievements have been associated with the economical design and operation of electricity works, and the development of electrical measuring instruments of precision. He has twice been President of the Institution of Electrical Engineers, before which he has read valuable papers on electricity supply—always setting a high ideal before the central-station engineer.

On Thursday afternoon the Hon. Sir Charles A. Parsons, K.C.B., F.R.S., was to open the proceedings. Few engineers have laid the country under so great a debt as he, and few have more thoroughly earned the admiration of their fellows. After receiving his engineering training at Cambridge, he proceeded to establish the firm of C. A. Parsons & Co., and to manufacture electrical apparatus, but his most brilliant achievement was the development of the steam turbine on the reaction principle from "a mere toy" to its present gigantic dimensions, both for driving machines on land and for propelling ships. The first compound turbo-dynamo, built in 1884, was rated at 10 h.p. and ran at 18,000 r.p.m. Since that date improvements have continuously flowed from the Heaton works, and turbo-generators up to 25,000 kW capacity have been built there. Sir Charles was elected a Fellow of the Royal Society in 1898 in recognition of his inventions, and the Institution of Electrical Engineers, in 1909, made him an Honorary Member in token of its admiration for his work.

Mr. J. E. Kingsbury, who was to open the session on Thursday evening, was elected a member of Council of the Institution for the year 1900-1901, became vice-president in 1903, and was re-elected to the Council in 1906 and 1911. On the death of Mr. Robert Hammond in 1915 Mr. Kingsbury was appointed Honorary Treasurer, which office he continued to hold until 1919. He was awarded the Fahie Premium for his paper on "Telephone Switchboards" in 1895. His earliest publication on "Telephone Subjects" was in 1882, and his latest, the practical history of telephone inventions and industry, was "The Telephone and Telephone Exchanges" in 1915. He read a paper also on "The Future of the Telephone in the United Kingdom" before the British Association in 1902. Unobtrusive but sagacious, he has constantly placed his ripe experience in the fields of commercial and financial administration at the service of the Institution, both in the Council room and

*Electrical Review, October 28th, 1921.

Photo by [*Vandyk.*

Mr. J. E. Kingsbury.

Photo by [*Elliott & Fry.*

Col. R. E. B. Crompton, C.B., R.E.,
Past-President.

Photo by [*Elliott & Fry.*

Sir Charles A. Parsons, K.C.B., F.R.S.

Photo by [*Elliott & Fry.*

Mr. J. S. Highfield,
President of the Institution of Electrical Engineers.

Photo by [*Lafayette.*

Dr. S. Z. de Ferranti.
Past-President.

Photo by [*Swaine.*

Professor J. A. Fleming, D.Sc., F.R.S.

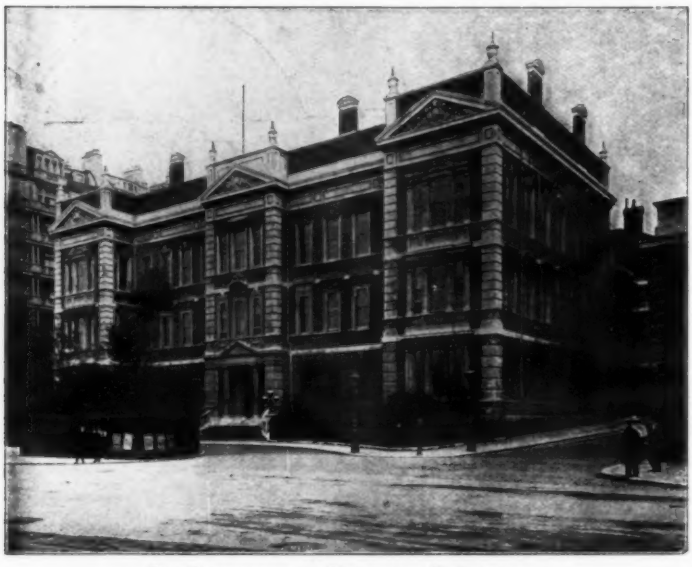
Photo by [*Vandyk.*

Mr. P. F. Rowell,
Secretary, and Editor of the *Journal*.

SOME PROMINENT MEMBERS OF THE INSTITUTION OF ELECTRICAL ENGINEERS.

in public debate, and has worthily upheld the dignity of the telephone industry as an important branch of electrical engineering.

The name of Dr. Sebastian Ziani de Ferranti is one which cannot be omitted from any review of the history of electrical engineering, whether it relate to this country or to the whole world; for it was he who, whilst Crompton was laying down the main lines of direct-current supply from central stations, fulfilled a similar function in respect of the alternating-current system. Before he was out of his 'teens, he made his way to the front by force of character and inborn genius; he planned the first "super-station" of 120,000 h.p. in 1888, adopted the system of connecting transformers in parallel instead of in series, and thus solved the problem of high-pressure transmission and low-pressure distribution. He founded the a.c. school which fought mighty battles with the d.c. school in the arena of the Institution of Electrical Engineers; he taught the world to generate outside the towns with large sets, transmit at high pressure along paper-insulated cables, and transform down for distribution—but he did far more than that. He made great improvements in the design and construction of alternators, switchgear, and meters, and always he combined with a charming personality an insight and a breadth of vision which were a living inspiration to his fellow members. The Institution is now travelling along the lines which he laid down in 1910, with what success is known to all, and not only the Institution, but the whole industry, owes him a debt which is beyond the power of expression.



The Institution of Electrical Engineers.

The Society of Telegraph Engineers was founded "to promote the general advancement of electrical and telegraphic science and its applications," and it may be of interest to consider how far it has fulfilled its rôle. In the first place, it has continuously provided an arena wherein electrical problems of every description may be debated, new methods and ideas brought forward and discussed, and accounts of progress both at home and abroad placed before its members. To all the stores of valuable information thus accumulated it has given the fullest publicity, not only through the medium of its own *Journal*, but also through the columns of the technical Press, to which it has accorded the most ample facilities. The Council is constantly co-operating with numerous other bodies in promoting the welfare of the industry, and in addition to the committees concerned especially with the affairs of the Institution, it has appointed a large number of committees to investigate and report upon subjects of more general interest, thus exercising a wide influence. In particular, the Wiring Rules, Model Conditions for Contracts, and (in conjunction with the British Engineering Standards Association) Standard Specifications have been of the greatest service to the industry in general, whilst by holding meetings abroad and by the work of the International Electrotechnical Commission in which it takes part, it has done much to promote international agreement and goodwill. From time to time—especially during the war—the Institution has directly assisted the Government in various ways, and in conjunction with the British Electrical and Allied Manufacturers' Association it has set up a Research Association under the aegis of the Department of Scientific and Industrial Research. It has brought together a magnificent library of some 15,000 volumes, and is the custodian of the Ronalds Library of 6,000 volumes, and has established a lending library; its own publications include the *Journal* and (in conjunction with other bodies) *Science Abstracts*—what does not appear in the one can readily be found with the aid of the other. The Territorial Centres and Sub-Centres which it has established throughout the Kingdom keep it in intimate touch with its members, and the excellent constitution which it has evolved is a model of democratic organisation. The high standard of qualification for membership which it has set up guarantees the maintenance of the status of its members on a high plane; some Dominion Governments already accept its membership as an unquestioned qualification.

Photo by] [*Photopress.*

The Lecture Theatre, February 16th, 1922.

The importance of the Institution to the economic life of the nation was fittingly recognised by the bestowal of his Patronage by His Majesty King George V, and of a Royal Charter of Incorporation, which most appropriately marked the completion of the first half-century of the Society's existence.

THE MERSEY POWER CO., LTD.

THE NEW RUNCORN POWER STATION.

(*Continued from page* 236.)

There are three furnaces to each boiler, and the hopper that serves each furnace is fed from the coal bunker by a sheet-steel chute, the hoppers being so arranged as to obviate any necessity for trimming in the stoker hopper; there are three coal chutes to each boiler, as mentioned above and shown in fig. 3.

Each boiler is provided with mechanical stokers of the chain-grate pattern that are operated by means of a line of shafting that runs the whole length of the boiler-house basement. The boilers operate under induced draught, and the two fans employed to create the latter are direct driven by electric motors which are housed in a bay at the end of the boiler-house; the 100-ft. high steel chimney stands upon a reinforced-concrete base about 20 ft. above the ground level.

The necessary steam gauge, draught gauge, and CO_2 recorder are all mounted on a column on the left-hand side of each boiler.

The feed water for each boiler is automatically controlled by a regulating valve; the feed water is supplied by three Weir rotary turbine-driven pumps, each of which is capable of delivering 175,000 lb. of water per hour. The speed of the pumps is governed by the water on the delivery side of the pumps, and the latter are also provided with emergency shaft governors that are arranged to interrupt the steam supply to the turbines that drive the pumps in the event of their speed becoming excessive.

The furnace ash-disposal plant was supplied by Messrs. Edward Bennis & Co., Ltd., of Bolton, and is of the suction type. It is capable of removing all the ash from the 12 chain-grate stokers, and it operates in the following sequence: As the ash falls over the end of the chain grates it drops into small hoppers that have been built underneath the back of the grates; the hoppers are emptied periodically as may be necessary by means of valves. The latter discharge into a portable electrically-driven ash crusher that is pushed along by hand on a light tramway track from one hopper to another as each is emptied in turn. The crushed ash then flows directly into a pipe that runs along the floor of the boiler-house basement, through a covered opening that is provided under each ash hopper. The ash is carried along the pipe by suction to a receiving tank that is located outside the building next to the chimney. After depositing the ash, the current of air is conveyed along a foul-air pipe to a filter, which extracts the fine ash dust that is held in suspension by the air and deposits it in a sludge tank; thus, the abrasive nature of the foul air is prevented from causing rapid wear of the internal fit-

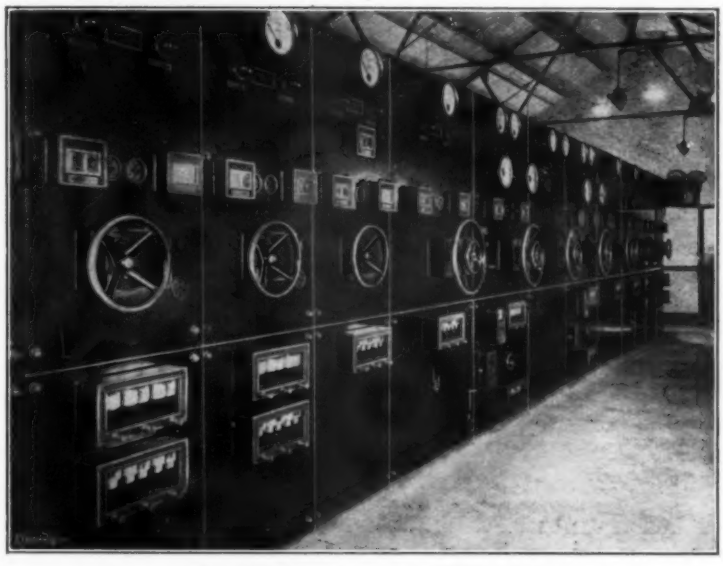


Fig. 5.—Main Control Switchboard.

Fig. 6.—Reyrolle Switchgear.

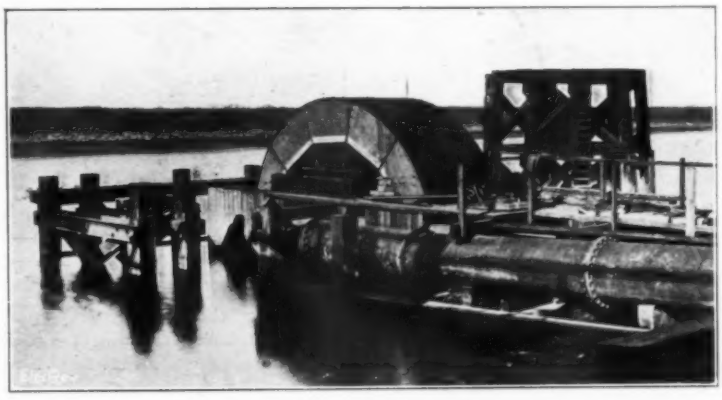


Fig. 7.—Condenser Water Screen.

tings of the plant. The filtered air is then passed forward to the exhauster and thence through exhaust pipes up the chimney.

The ash receiving tank is placed overhead at a sufficient height to allow railway trucks to pass beneath it so that its contents can be dumped direct into trucks; in addition, a shoot is provided to enable the ash to be delivered on to the ground, into barrows, or small trucks, if it becomes necessary to do so. The foul-air filter and sludge tank are mounted on an extension to the structure that supports the ash receiver, and are therefore also at a sufficient height to allow of the sludge being raked out into railway trucks beneath. The ash exhauster is of the Roots' blower type, and is driven by means of machine-cut spur gearing and a 100-b.h.p. electric motor. Water is admitted to the ash receiver for the purpose of quenching the hot ash and also to the top of the foul-air filter, the water supply being provided by an electrically-driven centrifugal pump that is located adjacent to the exhauster. The quantity of water delivered is automatically controlled by means of a valve in the main delivery pipe; the valve is connected to the air pipes and operates in such a manner that when no ashes are being carried along the pipes the supply of water is checked, or *vice versa*, the object being to prevent waste of water. A relief valve, which is automatic in its action, is also provided in the clean-air pipe at the entrance to the exhauster so as to allow the air to flow direct into the exhauster in the event of a chokage of the ash pipe taking place. A hand-operated "cat" crane is provided over the top of the receiver to facilitate the removal of any parts, and the plant is designed so that all parts of it are easily accessible.

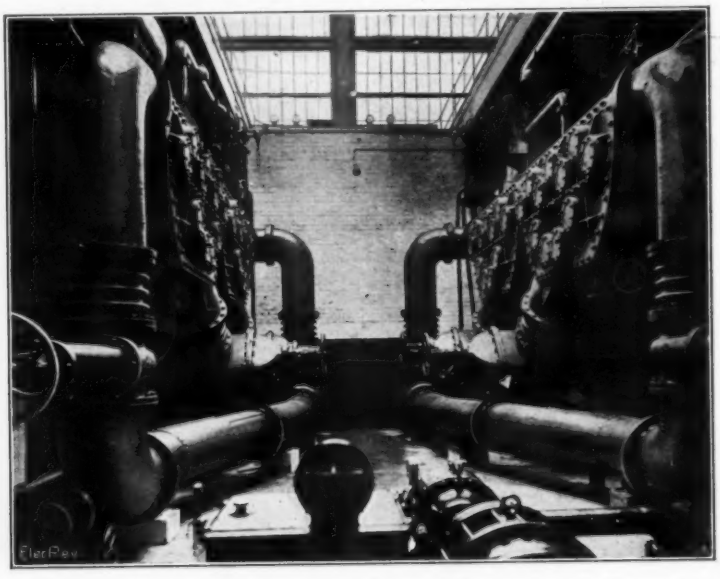


Fig. 8.—Twin Weir Condensers.

All the steam pipes are of solid-drawn mild steel, and all 7-in. and larger flanges are riveted to the pipes; riveted joints are also used on the main steam pipe, into which steam is conveyed by two 6-in. pipes from the superheater of each boiler. Two steam receiving drums have been installed in the turbine room, from which the turbines draw their supply of steam, while in the boiler-house basement a large Lancashire boiler shell is provided to act as a blow-down drum. The turbine room is spanned by a 50-ton travelling crane that was built by Messrs. Holt & Willetts, of Cradley Heath; it runs on rails 50 ft. above the basement level, and is supplied with electricity from side conductors. It has one 45, one 35, and one 10-h.p. motor, and is capable of travelling at a speed of 100 ft. per minute; an electro-mechanical brake is provided, which is released by a powerful solenoid that actuates immediately the power is switched on to the lifting motor, and is re-applied when the supply of electricity is interrupted or fails.

The two horizontal turbo-generators, one of which is illustrated in fig. 2, were supplied by Messrs. C. A. Parsons & Co., Ltd., of Newcastle-upon-Tyne, to run at a normal speed of 3,000 r.p.m. with steam at a pressure of 250 lb. per sq. in. at the stop valves and a temperature of between 650 and 700 deg. F. Their bearings are lubricated with oil, which is circulated through a cooler and strainers; the oil pumps are driven direct by the turbine shafts and maintain a constant oil pressure of 5 lb. per sq. in., while, in addition, a steam-driven pump is provided to supply the bearings with oil before the turbines are started up. All drains from the steam chests, piping, and valves are controlled by Sentinel steam traps.

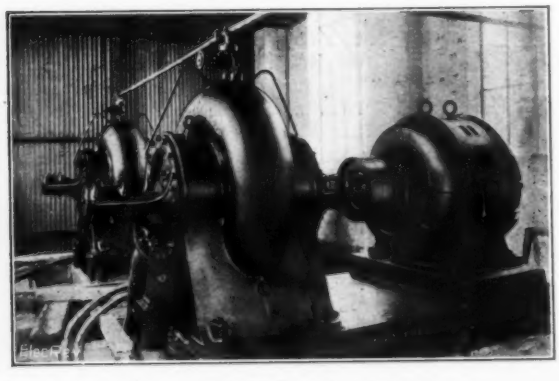


Fig. 9.—Condenser Water Pumps.

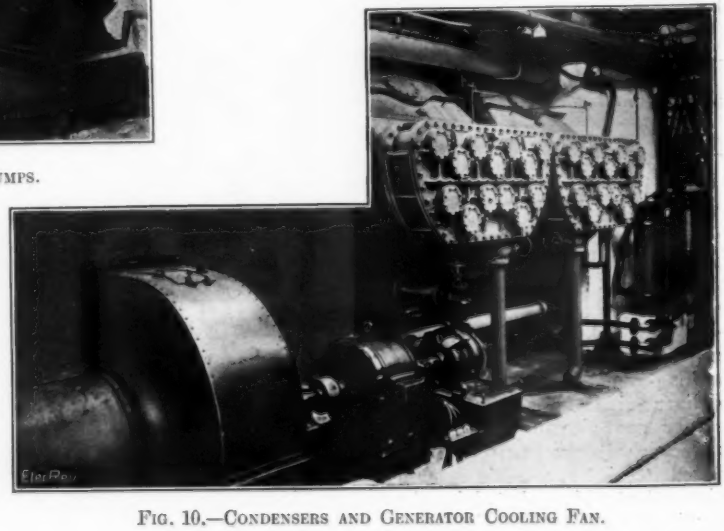


Fig. 10.—Condensers and Generator Cooling Fan.

(To be concluded.)

NOTES.

(Continued from page 267.)

Appointments Vacant.—Electrical mechanic, for the Borough of Islington, cleansing department; electrical engineer, for Calcutta (Rs. 540 monthly), for the Calcutta Electric Supply Corporation, Ltd.; two junior assistant mains engineers (300 taels per month) and one winder (300 taels per month, tael=3s.), for the Shanghai Municipal Electricity Deparment. (See our advertisement pages to-day).

Training of Hydro-Electric Engineers.—In its first interim report the Water Power Resources Committee recommended the institution of training facilities for engineers who were to enter the field of hydro-electric development. The Edinburgh Chamber of Commerce has considered this, and in a letter addressed to the Chairman of the University Grants Committee, the Minister of Education, the Secretary for Scotland, and the President of the Board of Trade, makes a number of suggestions for the carrying out of the Committee's recommendations. It is pointed out that Scotland, owing to its natural resources, is particularly interested in hydro-electric development, and that Edinburgh, on account of the already-existing facilities for the training of engineers, is the most suitable centre for the headquarters of a scheme such as that suggested by the Committee. The Chamber of Commerce accordingly recommends that the existing lectureships in hydraulics and electrical engineering at Edinburgh University and the Heriot-Watt College respectively should be used as the foundation of a system of hydro-electric training, and that an annual Government grant should be made to these two institutions to enable them to provide the necessary additional plant and apparatus.

Socials.—Last Saturday evening members of the British Thomson-Houston Co.'s Switchboard Section held their second annual dinner at the works canteen, Neasden Lane. The chair was occupied by the works manager, Capt. C. R. Acklom, R.N., U.B., C.B.E. The chairman's health was proposed by Mr. P. J. Samuels, charge hand of the section, and in reply, Capt. Acklom expressed the hope that before the next annual dinner took place the electrical trade would have overcome its post-war difficulties, and that all those present would be sharing in the better business awaiting the firm in the future. The visitors, who were toasted by Mr. F. Sumpter, included Mr. Heath, of the engineers (in the absence of Mr. Trencham), Mr. Hands, chief draughtsman, Mr. Cooke, chief accountant, Mr. Cresswell, and charge hands of all the sections of the factory. Mr. Hands responded, and intimated that he hoped to co-operate with them at a future date in arranging a gathering for the whole firm. A programme of music was arranged by the committee, which consisted of Messrs. F. Sumpter, G. Flavell, W. Pepper and W. Reid, assisted by Mr. R. Crisp. Messrs. Witcome and Laws, members of the drawing office staff, officiated at the piano.

On Saturday last the foremen of Messrs. Johnson & Phillips, Ltd., held their annual dinner at the Shakespeare Hotel, Woolwich, Mr. J. Bayne presiding. This year the managing director, with his departmental heads and other staff members, were invited to be present. Between 50 and 60 members of the company sat down to dinner, after which an excellent musical programme was given. In proposing the toast of "The Firm," the Chairman, Mr. J. Bayne, emphasised the necessity for thorough and complete co-operation between all members. In his reply, Mr. H. J. Sheppard, secretary and manager of the company, said he fully concurred that the true spirit of co-operation was essential if the conditions arising from the present industrial depression were to be met successfully. The Chairman proposed "The Visitors," and in responding Mr. Charles Stewart struck a note of optimism regarding the present industrial conditions. He said that in his travels round the country he found that there was a very distinct feeling that trade generally had at last taken an upward tendency. While there were no grounds for excessive elation, there was still every reason to think that the worst times had passed, and that it was only necessary for the spirit of comradeship referred to by the Chairman and Mr. Sheppard to be adhered to, to carry the affairs of the company to a peak higher than perhaps it had ever attained before. The musical programme was provided by Madame Daisy Hulbert, Messrs. James Paul, Hal Gader, Arthur Kearn and George Thomas, while Miss Andrews acted as accompanist.

Service Notes.—An Army Council Instruction has just been published, extending, in certain circumstances, the number of ex-Regular and ex-Territorial warrant and non-commissioned officers and serving Territorial warrant and non-commissioned officers who may be appointed permanent staff instructors of Territorial R.E. and Royal Corps of Signals units in cases where serving Regulars of the required ranks are not available in sufficient numbers to complete the establishment.—*Morning Post.*

The Parliamentary secretary to the Admiralty announces that H.M.S. *Vernon* is to be converted from a floating to a shore establishment, because the hulk is in danger of sinking; the mining school is to be merged in the *Vernon*, says *The Times*

Fatality.—A Bolton jury, on February 16th, returned a verdict of accidental death in the case of John Beddows, a motor engineer employed by Messrs Aspinall, Simm & Beddows, of the Daubill Garage. It was stated that the deceased was repairing a motor wagon, using an electric portable lamp, at a voltage of 200. Suddenly the lamp—which was without a cage—burst. A witness explained that it was probable that deceased was making some alteration in the bulb when some portion of his hands touched the wires, and completed the circuit. The lamp was fitted to an ordinary holder, without any protection.

Low-Temperature Carbonisation.—At a recent meeting of the Royal Society of Arts, Mr. E. V. Evans, the chief chemist of the South Metropolitan Gas Co., in the course of a paper on "Some Solved and Unsolved Problems in Gas Works Chemistry," suggested that the gas industry could deal, not only with the industries it was dealing with now, but also with the domestic fuel industry, for he felt certain that a time would come when a low-temperature carbonisation industry would come about if the gas industry did not take the steps to secure it.—*Financier.*

North-West Midlands Electricity District.—Commissioners' Inquiry.—On February 21st, at Wolverhampton, the Electricity Commissioners—Sir John Snell (chairman), Sir Harry Haward, Mr. H. W. Booth, and Mr. W. W. Lackie, who were accompanied by Mr. D. S. Cumberlege—opened an inquiry in connection with the above-named area, and the scheme that has been submitted by a conference of authorised undertakers for the establishment of a joint electricity authority for the district. An account of the proceedings will be published in our next issue.

The British Electrical Development Association (Inc.).—On Wednesday last the second annual general meeting of the Association was held at the Hotel Cecil, to receive the report of the Council and the statement of accounts, and to elect members of Council, auditors, &c. Afterwards luncheon took place, at which a large number of members and guests were present; the new President, Mr. Councillor E. C. Ransome, O.B.E., J.P. (chairman of Messrs. Ransomes, Sims & Jeffries, Ltd.), occupied the chair, and proposed the loyal toast. He then called upon Mr. Ll. B. Atkinson to propose "Electrical Progress," in the absence of the retiring president, Mr. Hugo Hirst, and Mr. Atkinson read a letter from that gentleman expressing his regret at his inability to be present and to show his admiration for the work of E.D.A. The purpose of the E.D.A., said Mr. Atkinson, was to develop the use of electricity; the public needed educating, and the work of the Association was succeeding, for the consumption of electricity was rapidly increasing. But there was still almost unlimited scope for the Association's efforts in promoting the use of electricity in the home. The electrical industry was suffering from two things— the reluctance of the people to incur even remunerative expenditure, and the uncertainty that prevailed as to the future of electricity supply. In cases where that uncertainty was absent, there was abundance of capital forthcoming for the electrical industry.

Responding, Mr. Arthur Neal, M.P., Parliamentary Secretary to the Ministry of Transport, said that what Mr. Atkinson had said with regard to E.D.A. could equally be said of the Electricity Commissioners. No effort would be spared by the Ministry to remove all obstacles and clear the path of the industry. The Ministry and the Commissioners were always glad to receive those who wished to make representations for the benefit of the industry. The Act of 1919 was intended to abolish waste; it was designed to secure not central control, but local autonomy. No new legislation was proposed which they need fear; in a few days a Bill would be introduced in the House of Lords to provide financial and other necessary powers, but no more. The Ministry was anxious that the electrification of railways should proceed, to find work for the electrical industry, and had encouraged the companies to go ahead with it; any difficulties that existed were in a fair way to be surmounted.

Mr. Councillor Ransome (president, E.D.A.) proposed "The Electrical Industry," taking an optimistic view of the future, and calling for confidence, co-operation, and economy. Mr. A. A. Campbell Swinton responded. The toast of "Our Guests" was given by Mr. A. F. Berry (chairman of Council, E.D.A.) and responded to by Sir Archibald Denny, Bart.

The Wimbledon Case.—As we go to press we learn that a public meeting is to be held at the Baths Hall, Wimbledon, on Monday, February 27th, at 7.45 p.m., Mr. Alderman H. W. Simpson in the chair. The principal resolution that will be put forward states: "That this public meeting of the burgesses of the Borough of Wimbledon protests against the action of the Electricity Committee and the Borough Council in summarily dismissing the electrical engineer without any statement of their reasons, and demands a public inquiry before any further action is taken."

Educational.—Summer Vacation Course.—We have received from the British Bureau of the Office National des Universités et Ecoles Francaises a pamphlet giving an outline of the summer holiday course of electro-technics at the Faculty of Science, University of Nancy. The fee for the course, which is of five weeks' duration, is 150 fr. Full particulars may be obtained from the Engineering Department of the Bureau, 45, Great Marlborough Street, W.1.

U.S.A. Electric Vehicle Market.—Business in the electric vehicle market is beginning to show definite signs of improvement. One of the largest makers of electric passenger cars states that the demand is slowly increasing, and he predicts that 1922 will be the best year for the electric vehicle industry since 1912, which was a record year. Another manufacturer of passenger cars has just placed on the market a new model, the design of which follows closely the lines of the best class of gasolene-driven cars, the batteries being placed under the bonnet and at the rear.

Makers of electric trucks are extremely optimistic with regard to the outlook for the current year. During the war and, in fact, until 1920 when the slump began, buyers of trucks were too prosperous to worry about operating costs, with the result that they naturally bought gasolene-driven trucks, the prices of which appeared to be attractive, but since that time many lessons have been learned, not the least of which is that the cost of operating an electric truck is considerably below the figure required for a gasolene-driven truck, and further, that electric trucks last longer.

The American Express Co. placed an order in January for fifty trucks; when these are delivered this concern will have 1,372 electric trucks in operation.

An extract from the report of the Joint Commission on the Postal Service in New York City, as submitted to the Senate, reads as follows:—

"A particularly thorough study was made of the relative merits of gas-driven and electric motors, and it is represented that a saving could be effected of 200,000 dollars a year by substituting electric for gasolene-driven machines. The engineers recommended, however, that as a preliminary step to the organisation of the fleet on an electric basis that electric machines be tried out in some small city."

One of the most novel uses for an electric truck is that which the Consolidated Gas Co. of New York has found for a commercial truck. Specially equipped with a tank of two hundred and fifty gallons capacity, this electric truck is used to collect the liquid left in the gas mains by the condensation which is continually occurring therein; this liquid is then taken to a refining plant where by-products are obtained from the condensed gas. The motive power admits of a cruising radius of about 50 miles, besides supplying energy to run a 60-volt centrifugal pump. This electric "drip" wagon, the only one of its kind, is doing the work that formerly required two horse-drawn vehicles. A vital reason for using an electric truck in this connection is its freedom from fire risk, which would not be the case if a gasolene truck were used.—*Reuter's Trade Service* (New York).

Concert.—To-night at 7.30 o'clock, at the Queen's Hall, Langham Place, W., a staff Bohemian concert (Babcock and Wilcox, Ltd.) will be held.

Railway Electrification.—Mr. Oliver Bury, general manager of the Great Northern Railway, presided, on February 17th, at the thirty-first annual smoking concert given under the auspices of the Railways Literary Society, and in a speech forecasted the electrification programme of the railway. He said Mr. Gresley, their chief locomotive engineer, intended to introduce some monster engines on the Great Northern Railway. The scheme for electrification was making good progress, and the death of the steam engine was certain.—*Financial Times.*

Engineering Lock-out Threatened.—A report published on Wednesday evening stated that on that day the Amalgamated Engineering Union and the Engineering and Shipbuilding Trades Federation were officially informed that as from March 11th the Engineering Employers' Federation would, in consequence of there being no agreement between the parties, post notices declining to employ any member of the Trade Unions concerned unless the Unions permitted overtime and night-shift work wherever necessary.

A report in the *Daily Telegraph* of Wednesday stated that an influential section of Birmingham engineering employers had given notice to withdraw the 26s. 6d. cost of living bonus from their employés in three "cuts." This threatened action was to be discussed in Birmingham yesterday by the men's representatives, some of whom had declared that the whole of the industry was threatened with a grave lock-out in the third week of March.

Electrical Progress in Brazil.—With the inauguration of the establishment at Ribeirao Preto, belonging to the Companhia Electrica Metalurgica Brazileira, a beginning was marked in South America of the use of electricity for smelting purposes. The company is working in connection with the Empreza Força y Luz de Ribeirao Preto, which is furnishing the necessary power. The erection of the plant at Ribeirao Preto is making substantial headway. The capacity of the mill after a few months' operation will be 60 tons of steel daily.

An extensive system of electric lighting is to be introduced into the town of Ribeirao Preto, a company known as the Empreza Força y Luz de Ribeirao Preto having been formed for the purpose, with a capital of 6,000,000 milreis. The company, by the terms of its contract, undertakes to install and exploit an electric service as well as a calcium-carbide factory, and to furnish contracts and facilities in the neighbouring municipalities for the exploitation of light and power services, along with water and sewer systems. The company will be obliged to furnish all power that may be required for industrial purposes in that zone, as well as to construct and work a complete irrigation system, either on its own account or for the account of third parties. Among the towns which the company will undertake to supply, and for which it will hold exclusive privileges of light and power, in addition to the town of Ribeirao Preto are: Gravinho, Sertaozinho, Jardinopolis, Orlandia, Brodowski, Sao Joaquim, Ituerava, and Igarapava. A hydro-electric plant is about to be installed on Jucu River, in the State of Espirito Santo (Brazil), in order to supply the city of Victoria with electricity. Sufficient progress has been made with the electrification of the Paulista Railway (Brazil) to enable it to be said that the transformed line will be open to traffic by the end of this year. The whole of the electrification for a distance of 44 km. has been carried out by a United States electrical company.

An electric lighting system is about to be installed in Tubarao, in the State of Saint Catharina.

A concession granted to construct a hydro-electric plant on the Paraguassú River, in the State of Bahia (Brazil), has been transferred to the Companhia Brazileira de Energia Electrica. A natural fall on the river is being used to generate 5,000 h.p., and construction has been progressing steadily. The plant is expected to be in operation almost immediately, when the company will be in a position to supply the city of Bahia with light as well as power for the tramway system, while it also expects to supply a number of manufacturing firms and sugar refineries with power, which will reduce the demand for coal and fuel-oil, which are now very costly.

A hydro-electric plant has been inaugurated by the Companhia Valenca Industriál, built on the Falls of the Una River. Besides providing power for a textile factory belonging to the company, it will supply the city of Valenca with electric light. The hydro-electric plant on the River Jaguaripe, owned by the firm of E. Tude & Co., of Bahia, has been increased by one set, the plant being constructed to supply power for the vegetable-oil refinery of the firm mentioned. The greater part of the installations, plant, and machinery for these hydro-electric establishments has been received from the United States, and the remainder from Europe, principally from Germany and Switzerland.

The dependence of Brazil upon foreign sources for fuel, there being no coalfields available, has caused the Government to give special attention to the electrification of the railways of the State, and a British company has now presented elaborate plans for the electrification of the whole of the lines of the State of Sao Paulo. The proposition of a general programme of electrification has long been under consideration, the most important railway in this district having already taken steps to carry it out upon its own system. The development of the hydro-electric industry had already reached a high point before the war. Forty-seven plants, developing approximately 112,000 h.p., were in operation, the largest developing 50,000 h.p., and furnishing sufficient power to operate nearly all the manufacturing enterprises in the State of Sao Paulo. Arrested by the European War, development of the hydro-electric industry is again showing extension, and may be expected to progress still more in the near future, a fact worthy of the attention of British manufacturers of hydro-electric plant.—*Reuter's Trade Service* (Rio de Janeiro).

Oil Transmission Gear for Electric Locomotives.—Locomotive engineers will be watching with some interest for the results of the trials to be commenced early this year in which the Lenz oil transmission gear will be applied to electric and Diesel-driven locomotives. A 200-300 b.h.p. transmission set is now under construction for the Prussian railways with a view to ascertaining whether this form of drive will enable improvements to be made in the design of the existing electric locomotives. This oil gear is also going to be tried on a mountain railway, and a running programme of 100,000 kilometres has been arranged to extend over the year.—*Model Engineer.*

The Greater London Transport Problem.—Speaking at a meeting of the Surveyors' Institution, Westminster, on "The Problems of Greater London," Mr. W. R. Davidge, F.S.I., F.R.I.B.A., A.M.Inst.C.E., said the recent establishment of a Royal Commission to inquire into the local government of the county of London and the surrounding districts had brought into prominence the particular problems concerned with local administration. Transport, not only of the inhabitants, but of their food and supplies, their merchandise, their coal and their building materials, formed the main difficulty of Greater London, and differentiated it from all other communities. The bulk of the population were dependent upon London for their work, so that the locality of their homes was dictated by the transport facilities available. The exact limitations of choice were defined (*a*) by the time taken in transit; (*b*) by the cost of travel. In certain directions the time had been greatly reduced by the electrification or other speeding-up of the means of transit. Immediately the line became popular the effects of overcrowding became apparent. Traffic congestion and strap-hanging were most in evidence where the transport facilities afforded the greatest attraction. The dis-

comforts of travel for suburban Londoners were becoming well-nigh unbearable. The facilities for quicker travel had much increased, but had nothing like kept up with the increased number of people who now travelled to and from London daily. The railway companies were electrifying their services, but more people had to stand up. The Underground Railways did their best, the motor-omnibuses and tramways carried their full quota, but in the rush hours the overcrowding and discomfort were intense. Even the tubes, their fastest means of conveyance, had so many stops that the average over-all speed could not be much more than 18 miles an hour. The whole of the transit system in Greater London required to be overhauled and improved. If the new central authority was to have any real power to improve London it must start by controlling all means of traffic. There were nearly 670 miles of railway and some 628 passenger stations. Railways must be used as railways, and not attempt to stop every half-mile or mile. The tube railways of London had been planned with stations at every important point, and it became impossible to get really rapid transit under these conditions. If this was to be done either a large number of stations must be closed, or, preferably, another "express" tube driven underneath, with very few stations. The heavy cost of tube railways—about £600,000 a mile—was almost entirely due to the stations, which were responsible for three-fourths of the cost. If the stations were kept five miles apart a railway of double the length could be constructed at half the price, and provide really rapid transit to the outskirts. Great extensions of the tubes and underground railways would have to be made in all directions. In the south-eastern section of London not a single tube had yet been constructed, and there was a big field for new construction. Should the central authority finance these, as was done in New York, or construct them, or merely control them? Government control was insufficient, and the new central authority must have a thinking department, which would look ahead and provide for future needs. The main functions of the omnibuses should be to carry short-distance passengers and act as feeders to the railway systems, although in the outlying districts, where traffic was light, a frequent service of 'buses or tramcars was of the utmost value in opening up a district for development. The great advantage of the motor-'bus was its flexibility, which rendered it largely independent of other vehicles, and also enabled routes to be changed at any time. Tramcars, with their large holding capacity, conveyed a vast number of passengers, but nothing like the full use was obtained from them owing to frequent stops and traffic blocks. In the outskirts especially the tramways might well become light railways, running on special tracks—not necessarily alongside roads. The well-known examples of light railways running between Lille and Tourcoing or Cologne and Bonn would rise to the mind in this connection. If the new central authority was to regulate all traffic in Greater London it obviously should not itself be a competitor; it must either own all or none, but control it must have.

Shipyard Electrification.—The machine shops and sheds, cranes, and other appliances in a shipyard are usually scattered over such a wide area that the problem of power transmission becomes of considerable importance. But perhaps the greatest argument that can be advanced in favour of shipyard electrification is that many of the largest shipbuilding firms in the country use electricity for almost every power purpose, including the generation of power for the hydraulic and pneumatic systems, both important features in every shipyard.

Examples of such yards are those at Jarrow and Hebburn-on-Tyne, which are owned by Messrs. Palmers' Shipbuilding and Iron Co., who have made wide use of electric motors, more particularly in the yard at Hebburn-on-Tyne. First, however, attention is directed to the Jarrow yard, where compressed air is utilised for various purposes. Some years ago a 400-h.p. "Witton" induction motor was supplied for driving an Alley & McLellan compressor of the two-stage enclosed design, which includes an intercooler. It has a working pressure of 100 lb. per sq. in., and a special feature of its design is that it is capable of high efficiencies, whether running on full or light load. A second motor-driven compressor (an exact duplicate of the foregoing one) was installed some three years ago; the motors are started by a bank of oil-immersed rotor starters, which are operated through worm gearing by a small handle. It is a testimony to the satisfaction given by the motors that, when requiring further machines for the equipment of the Hebburn-on-Tyne yard and its other works, the company should place orders with the G.E.C. for a number of machines totalling, in the space of a few years, over 120.

The Hebburn-on-Tyne yard occupies an area of some 43 acres, comprising five building berths, three platers' sheds, a graving dock, a frame assembling and riveting shed, two stock banks, fitters' shops, compressor house, and so forth. Throughout these various sections the electric drive is used wherever possible, power being obtained from the 6,000-volt a.c. mains of the Newcastle Electric Supply Co., transformed down to 440 and 240 volts d.c. by rotary converters. The crane in the platers' yard is controlled by three "Witton" motors, with ratings of 20, 10, and 3 h.p., for hoisting, longitudinal travel, and cross-travel respectively. Platers' shed No. 1 contains a wide range of machines for punching, shearing, planing, drilling, counter-sinking, &c.; the most interesting in it is the plate-straightening rolls, which is one of the largest of its kind in this country. It is capable of accommodating plates up to 40 ft. by 6 ft. 9 in. in size by 1¼ in. thick. The rolls are driven by a 120-h.p. slip-ring motor, the screwing-down motion being controlled by two 20-h.p. slip-ring machines. Platers' shed No. 2 contains equipment of a similar nature to that just mentioned. The main stock bank is situated at the south side of the third platers' shed, running practically the full width of the yard, and covering an area of 3 acres. The complete handling of plates on this bank is accomplished by a 5-ton Brown hoist transporter crane. All the motions required, namely, hoisting, longitudinal travel, and cross travel, are controlled by a 125-h.p. slip-ring motor, driven through bevelled spur gearing and clutches.

The compressor house is situated in close proximity to the river, and a recent addition to its equipment consists of a Belliss & Morcom compressor driven by a 650-h.p. "Witton," 440-volt, 40-cycle, 238-r.p.m., slip-ring motor. Several of the motors are controlled by suitable forms of G.E.C. starter gear, mainly of the drum type. This yard is an excellent example of the electrified shipyard, the rapidity with which the plates are handled and machined being very noticeable.

A High-power Lighthouse.—According to present arrangements, a lighthouse for the guidance of aeroplanes, having a lantern of one milliard candle power, will be erected in the early summer on Mont Afrique, near Dijon, in the very centre of France. In average weather the visibility, it is calculated, will be 150 miles, and in very clear weather about 220 miles or even more. The diameter of the lantern will be about 17 ft.—*Reuter's Trade Service* (Paris).

INSTITUTION NOTES.

Institution of Electrical Engineers.—Informal Meeting.—At an informal meeting, on February 13th, Mr. F. Pooley was in the chair and Mr. J. H. Parker opened a discussion on "The Evolution of a Staff Trade Union." Mr. Parker kept a large gathering keenly interested while he told at considerable length the story of the beginnings and the growth of the E.P.A. He told of protraction negotiation with the councils and authorities over the wages schedule and of temporising and evasion by these bodies, which, in many cases, had yet to honour their agreement. He protested against misrepresentation of the aims and intentions of the E.P.E.A., which, on occasions of acute public interest, were often sensationally proclaimed by the lay Press. He declared that the policy of the E.P.E.A. was to secure the welfare of the whole industry, to avoid strikes, and, above all, the lightning strike, and he explained the past action of his organisation in declaring in advance of disputes which might involve its members a readiness to support the side willing to arbitrate in that dispute. Bearing on this claim of moderation, he read one of the vital rules of the Association, which stated that in case of any dispute calling for extreme action, 70 per cent. of the whole membership must agree to the proposed action, and he urged that this was ample safeguard against any impulsiveness. The subsequent discussion brought out a few points of explanation and criticism, but very little opposition. Mr. A. F. Harmer proclaimed his entire agreement with Mr. Parker, but deplored the necessity for trade unions. Dr. J. F. Crowley hoped for closer association between the E.P.E.A. and the Society of Technical Engineers. He thought that the only protection that was afforded to staff men from being forced into a manual workers' union was to organise themselves. In a manual workers' union they would be in a hopeless minority and could not be adequately voiced. He hoped Mr. Parker's address would be printed in full and given the wide circulation it deserved. Messrs. W. E. Rogers, Norman Wyld, J. R. Bedford, F. C. Knowles, F. T. Hall, E. W. Jones, J. R. Bowden and W. H. M. Kelman also took part in the discussion.

Smoking Concert.—The third annual smoking concert of the Informal Meetings Section is to be held at the Engineers' Club on Monday next, the 27th inst. Mr. W. E. Warrilow will take the chair.

Scottish Centre.—The fourth ordinary meeting of the 1921-2 session of the Scottish Centre of the Institution was held at Glasgow on February 14th, when Major J. Erskine Murray delivered a lecture entitled "The Uses of Wireless, Past and Future." Mr. E. T. Goslin, chairman of the Centre, presided.

Dr. Erskine Murray treated his subject in a popular manner, and sketched the present position of civil and military wireless work. He showed a large number of lantern slides of typical installations and individual pieces of apparatus, paying special attention to the thermionic valve. In the course of the lecture he illustrated the possibilities of small portable receiving sets by rendering German signals audible to the audience. In order to bring home the principles on which the signalling was founded, Dr. Erskine Murray showed one or two experiments on mechanical resonance by means of a cord and suspended weights.

A vote of thanks was proposed by Professor Magnus MacLean, who humorously suggested that the messages received were faked and that the lecturer was imposing on the credulity of the audience.

Prof. G. W. O. Howe, first occupant of the Chair of Electrical Engineering in Glasgow University, seconded Dr. MacLean in an appreciative speech.

The meeting was well attended by members of the Institution, and, in addition, there was a deputation from the Glasgow Radio Society.

Institution of Civil Engineers.—On February 7th Dr. H. F. Parshall read a paper on "The Hydro-Electric Installations of the Barcelona Traction, Light & Power Co." The undertakings described were: the Tremp-Talarn scheme, which develops 28,000 kW, and which cost £1,826,700; the Aytona scheme, which cost £1,852,260, with a power of 32,000 kW; and the Camarasa installation, the cost of which was £1,370,776. The last was designed for five 12,500-kW sets, but only two of these are at present in commission. The combined annual output of these three undertakings is about 430,000,000 kWh.

Institution of Mechanical Engineers.—The annual report of the Council for the year 1921 shows that the membership (all grades) rose by 491 to 7,994. The accounts record a balance of revenue over expenditure of £2,050. It is reported that the new Local Branches, Midland, North-Western, and Yorkshire, have been successfully carried on during the year, and, in response to a petition from members in the district, a South Wales Branch was formally established in November last. The Institution has assisted the War Office in obtaining mechanical engineers for the Reserve of Officers, and also in connection with the Tank Corps and other branches of the Service. Among the information given in the report are details of awards for papers, &c., and a list of bodies upon which the Institution has been represented.

Faraday House Old Students' Association.—The revised edition of the rules and list of members of the Association, which was founded in 1905, shows that the total number of members is now 544. Mr. P. V. Hunter, C.B.E., is president for 1922, while the council consists of Messrs. L. W. Bollard, A. W. Berry, S. Bramley-Moore, M.C., S. W. Carty, M.C., O.B.E., A. T. Morris, L. H Short, M.C., R. G. Vanneck, M.C., H. T. Werren, J. F. Watson, H. W. Swan, Major C. E. Prince, O.B.E., Dr. F. T. Chapman, and Dr. A. Russell (*ex-officio*), Messrs. H. Foulds and H. W. Fairman being hon. treasurer and secretary respectively. The balance of income over expenditure for 1921 was £12, as compared with a surplus of £16 for the previous year. The balance carried forward to 1922 amounts to £90, against £78 brought forward from 1920.

A smoking concert, given by the Faraday House Old Students' Association, will be held on March 17th, at 8 p.m., at the Queen's Hotel, Leicester Square. As the accommodation is limited, members are advised to make early application to the hon. secretary of the F.H.O.S.A., Faraday House, W.C.1, for tickets.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Messrs. Underwood (Manchester), Ltd., announce that Mr. H. Garside Thornton, formerly their sales manager, is not now acting in that capacity.

A special meeting of members of the F.B.I. in the Leeds district was held on Tuesday at Leeds to do honour to Col. O. C. Armstrong (chairman of Messrs. Greenwood and Batley, Ltd.), in recognition of his election as president of the Federation.

Mr. E. H. Fisher has been promoted to be superintendent, and Mr. D. Thomas to be assistant superintendent, in the Telegraph Branch, G.P.O., Edinburgh.

The Worthing Electricity Committee has appointed Mr. E. G. Stagyle, who for the last 11 years has been assistant electrical engineer to the Tonbridge Urban District Council, to be assistant electrical engineer at Worthing. There were 109 applicants for the appointment.

In a paragraph appearing in our last issue, the name T. M. *Jornson* should have been rendered as Johnson.

Obituary.—Mr. H. J. Eeles.—We regret to record that Mr. H. J. Eeles, secretary of the Oxford Electric Light Co., suddenly died on Monday night while addressing a meeting of the Alliance of Employers and Employed on the subject of the factors operating against a revival in trade.

Wills.—The late Mr. Algernon Turnor, sixteen years Financial Secretary to the Post Office, left £54,463 gross, and £53,869 net personalty.

The late Mr. A. W. Herve, screw manufacturer, of Clerkenwell Road, London, left £120,043 gross.

NEW COMPANIES REGISTERED.

Metallisation, Ltd. (179,721).—Private company. Registered February 15th. Capital, £75,000 in £1 shares. To acquire any inventions relating to the coating of surfaces with metal, and/or applying deposits of metal or metallic compounds to surfaces; and to adopt agreements (1) with W. J. Thompson, and (2) and (3) with E. T. White. The subscribers are:—C. Tilt, Wembley Dene, Wembley Park, Middlesex, mechanical engineer; C. P. N. Raikes, 106, King Henry's Road, South Hampstead, N.W.3, electrical engineer. The first directors are: W. J. Thompson (chairman), E. T. White (managing director), and G. Dennison. Qualification (except first directors), £1,000. Remuneration, £200 each per annum (chairman £300). The managing director shall be entitled to 2½ per cent. of the profits in each year after 15 per cent. dividend has been paid. Solicitors: Francis & Johnson, 19, Great Winchester Street, E.C.

H. S. Kemp & Co., Ltd. (179,718).—Private company. Registered February 13th. Capital, £1,200 in £1 shares. To carry on the business of electrical engineers, manufacturers of electric lamps and fittings, tool makers, brassfounders and metal workers, &c. The first directors are:—W. F. Bond, Windsor House, Kingsway, W.C.2 (or such other person as shall be nominated by Belco, Ltd., of Windsor House, Kingsway, W.C.); E. A. Boxall, 57, Penshurst Road, Thornton Heath, Surrey; H. S. Kemp, 133, Gloucester Road, Regent's Park, N.W.; A. E. Cage, 3, Harrington Street, Hampstead Road, N.W. No qualification required for nominee of Belco, Ltd.; qualification of other directors, £100. Registered office: 25, Stephen Street, Tottenham Court Road, W.C.1.

Selco, Ltd. (179,702).—Private company. Registered February 14th. Capital, £100 in £1 shares. To carry on the business of import and export merchants and agents, consulting, mechanical and electrical engineers, financial agents, brokers, &c. The subscribers (each with one share) are: Mackie Galstaun, 247, Fulham Road, South Kensington, S.W.3, electrical engineer; Nellie Schofield, 27, Edridge Road, East Croydon, solicitor's clerk. The first directors are not named. Solicitors: Gisborne, Woodhouse and Co., Temple Chambers, Temple Avenue, E.C.4.

Auto-Electrical Services, Ltd. (179,760).—Private company. Registered February 17th. Capital, £2,500 in £1 shares. To take over an agreement made between C. A. Vandervell & Co., Ltd., of the one part and R. V. Steward of the other part; to enter into an agreement to acquire the formulæ and process of manufacturing electrical dry batteries; and to carry on the business of manufacturers, sellers or agents for the sale of electrical dry batteries and accumulators, manufacturers of acids, electrical appliances or accessories, automobile, aircraft, and marine equipment for lighting, starting, and ignition, &c. The permanent directors are:—N. F. Steward, 88, Darlington Street, Wolverhampton; R. V. Steward, "Walmer House," Waterloo Road, with power to appoint other directors. Qualification, £50. Remuneration as fixed by the company. Secretary: C. Brassington. Registered office: 14, Lichfield Street, Wolverhampton.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Melbourne Electric Supply Co., Ltd.—A trust deed dated January 31st, 1922, to secure 2,500,000 dollars in gold currency of the U.S.A. has been registered, charged (specifically) on freehold properties in Australia and (as a floating security) on the company's other assets, present and future, including uncalled capital, subject to first and second debenture stocks and 5 year 6 per cent. general mortgage gold bonds. Trustees: Anglo-American Debenture Corporation, Ltd.

Simms Motor Units (1920), Ltd.—Satisfaction to the extent of £3,210 2s. 11d. on various dates from July 29th, 1921, to February 3rd, 1922, of second mortgage dated April 30th, 1920, securing £4,818 15s.

Pewsey Electric Lighting Co., Ltd.—Particulars of £2,000 debentures authorised November 18th, 1921; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

Charles Winn & Co., Ltd.—Satisfaction to the extent of £9,000 on January 31st, 1922, of debentures dated September 11th, 1918, securing £30,000.

Anglo-Portuguese Telephone Co., Ltd.—Satisfaction to the extent of £10,000 (being amount issued) on March 2nd, 1905, of second mortgage debentures dated December 29th, 1902, and September 14th, 1903, securing £40,000. (Notice filed February 10th, 1922.)

Drake & Gorham, Ltd. (70,275).—Return dated November 10th, 1921. Capital, £125,000 in £1 shares. All shares taken up. £85,000 paid, £40,000 considered as paid. Mortgages and charges, £12,000. 10 per cent. seven-year notes, £50,000.

Allen-Liversidge, Ltd.—Satisfaction in full on February 14th, 1922, of debenture dated April 14th, 1920, securing £50,000.

Eastern & South African Telegraph Co., Ltd. (13,306).—Return dated December 13th, 1921. Capital, £600,000 in £10 shares. All shares taken up and paid for in full. Mortgages and charges, nil.

Appleby Crane & Transport Co., Ltd.—Sir William B. Peat, of 11, Ironmonger Lane, E.C., ceased to act as receiver or manager on February 10th, 1922.

CITY NOTES.

British Columbia Electric Railway Co., Ltd.

The annual meeting of shareholders was held in London on February 14th. Mr. J. Davidson (deputy-chairman) presided in the absence, through illness, of Mr. R. M. Horne-Payne. In presenting the report (which was dealt with in our issue of February 10th), the chairman said that the increase in gross earnings had been almost wholly absorbed by increased costs, mainly due to higher wages; the net earnings, therefore, only rose by £9,058. There had been a remarkable growth in statistics during the year under review. The number of passengers carried increased from 66,411,030 to 71,065,275; the number of kWh of energy sold rose from 120,173,919 to 140,285,620; 45,770,600 cu. ft. of gas had been sold, as compared with 41,746,000 in the previous year. Freights had fallen off slightly, 412,534 tons being carried, as against 430,931 in 1919-20. The increase in net earnings was not due to high charges, but to ever-growing efficiency in the working of plant and equipment, to constant and vigilant attention to

every detail, and to the most economical and efficient management. The tramway fares charged by the company in Vancouver, Victoria, New Westminster, and North Vancouver were at a flat rate of 6 cents. In only two other Canadian cities were fares as low as this, and in no city were they lower. The right to charge 6 cents extended to July 1st, 1922, and it was essential if a proper service was to be maintained that this fare should be retained after the date mentioned. Although negotiations to this end had proved that the Vancouver City Council was agreeable, the people of the city were against the retention of the increase, mainly, the chairman thought, because the necessity for it was not understood. With regard to lighting rates, not only had the company not increased its tariffs, but two reductions had been made since 1914, and the lighting rates charged in Vancouver were actually 23 per cent. below the pre-war level. There were now only nine cities with a population of over 50,000 in Canada and the United States where lower rates were charged. The price of gas had remained constant by reason of improved efficiency in production. The prospects for the current year were excellent, the only doubtful feature being the matter of the Vancouver tramway fares. The degree of progress exhibited in the company's policy was dictated by its ability to raise further capital; this was impossible unless fares were so stabilised as to make the forecasting of revenue reasonably certain. Until then capital expenditure would be avoided. The purchase of the Western Power Co. of Canada ensured a present and potential supply of power covering all requirements for many years to come. A recent examination of the company's existing power plants showed that, for a relatively moderate capital expenditure, an additional 10,000 kW might be added to the capacity of these undertakings. An additional unit now being erected in the Western Co.'s undertaking would give a further 7,500 kW. It had also been stated that as much as 80,000 h.p. was obtainable from the development of the second power site owned by the Western Power Co. of Canada. The development of these resources depended upon the growth in demand, and also, in a large measure, to the encouragement received to develop further resources. Arising out of the high prices of fuel, it had become fashionable to represent that water-power development was always cheaper than steam generation. This was not so; there were many cases in which the development of water-power would be unprofitable and a steam plant would be preferable. There was a danger of over-development of water-power in Canada—the supply exceeding the demand. The market for power should be made sure of before water-power schemes were proceeded with. The speaker ended with an appeal to the people of Vancouver to serve their best interests by supporting the company's forthcoming application to be transferred from provincial control to that of the Dominion Railway Commission, or by granting the company the right to charge a 6-cent fare for a period of ten or twelve years.

Underground Electric Railway Companies.

We give below a summary of the results of working of the five companies (including the London General Omnibus Co.) constituting the "Underground" group, for the year ended December 31st, 1921. As the Metropolitan District Railway was still under Government control during 1920 the traffic receipts and expenditure for that year are not comparable with those for 1921, and the differences are therefore omitted:—

	1921.	Increase + or Decrease −
	£	£
Traffic receipts	12,498,641	—
Expenditure	10,425,930	—
Net receipts	2,072,711	+ 850,330
Miscellaneous receipts (net)	586,916	− 107,083
Total net income	2,659,627	+ 743,247
Deduct—		
Interest, rentals and fixed charges	867,628	+ 41,717
Appropriations to reserves	530,000	+ 110,000
Dividends on guaranteed and preference stocks	389,477	+ 29,400
Total deductions	1,787,105	+ 181,117
*Balance	872,522	+ 562,130
Add balance from last year's accounts	135,711	+ 1,433
Total amount available for dividends on ordinary stocks and shares and for other purposes	1,008,233	+ 563,563
Amount paid in dividends on ordinary stocks and shares representing an average rate of 3.92 per per cent. in 1921 and 1.66 per cent. in 1920	755,091	+ 446,132
Balance carried forward to next year's accounts	253,142	+ 117,431

*During the first half of the year 1921 the dividend on the Second Preference Stock of the Metropolitan District Railway Co., amounting to £36,750, was met out of that company's share in the Common Fund. If this is added to the balances, £877,522, the total represents the Common Fund for the year 1921.

The traffic statistics for the year show a falling off; the totals are given below:—

Passengers carried—			
Ordinary	990,505,876	−	51,244,390
Workmen	52,812,646	−	21,019,703
Season	56,559,400	+	440,147
Total	1,099,877,922	−	71,823,946
Number of car-miles run	144,629,823	−	4,099,077

The reports of the four railway companies are briefly given below:—

Central London Railway Co.—The total net income amounted to £261,122, an increase of £94,553; £15,161 was brought forward, making a total of £276,283. The following deductions were made: Interest, rentals and other fixed charges, £46,099; appropriation to reserve, £29,000; and dividend on preference stock, £21,600. This left a balance of £179,644, and after payment of final dividends a balance of £59,644 is carried forward.

Metropolitan District Railway Co.—The total net income increased by £122,713 to £662,553, which, with a balance of £20,537 brought forward, made a total of £683,090. After deducting £326,760 for interest, rentals, and other fixed charges; £65,000 appropriated to reserve; and £198,430 as dividend on guaranteed and preference stocks; an available balance of £92,900 remained. After payment of final dividends a balance of £60,550 is carried forward.

London Electric Railway Co.—The total net income was £808,408—an increase of £243,482. This, with a balance of £22,350 brought forward, made a total of £830,398. Interest, rentals, and other fixed charges absorbed £295,544; £65,000 was transferred to reserve; and dividend on preference stock absorbed £126,947; leaving £342,902 available for distribution. A balance of £22,350 is carried forward after payment of final dividends.

City and South London Railway Co.—The total net income showed an increase of £41,478, being £179,867. A balance of £18,820 was brought forward, making a total of £198,687. The following deductions were made: Interest, rentals and other fixed charges, £46,811; appropriation to reserve, £36,000; dividends on preference stocks, £42,500; leaving a balance of £73,376. After the payment of final dividends a balance of £25,276 is carried forward.

North Metropolitan Electric Power Supply Co., Ltd.

Mr. E. Garcke presided at the annual meeting of the company on February 16th. He commenced by stating that an issue of £250,000 8 per cent. second preference stock was contemplated by the directors, and subject to sanction being received a prospectus would be issued in a day or two. The net revenue for the year under review again showed a record increase; in the course of two years the balance of the company's net revenue had more than doubled. The gain of over 20 per cent. in net revenue had been made in spite of many difficulties. The coal strike had not only resulted in decreased output, but had also involved the company in the expense of installing oil fuel burners, and the purchase of low-grade coal at exorbitant prices. The company had succeeded in maintaining the supply throughout the period of the dispute. The capital expenditure during the year totalled £240,000. This was mainly expended upon new generating plant which was not only necessary to enable the company to meet the demands of consumers but also to effect considerable economies in working. Other revenue-producing expenditure had been made upon transmission lines and distribution mains. The company was now giving bulk supplies to eight local authorities and companies who acted as distributors. In conjunction with the allied distribution company, the North Metropolitan Co. was now operating thirteen separate undertakings. As mentioned in the report, the Electricity Commissioners had agreed to preserve the rights of the company in formulating the scheme for London's electricity supply. The company's plant had been increased during the year by a 5,000-kW turbo-generator set, and it was hoped to install a further 15,000 kW during the present year. Nine new sub-stations had been erected and put into service during the year. In the Bill being promoted by the company in the present session of Parliament sanction was being sought to the revision of prices and methods of charging, and to the taking over of the distribution company's undertakings, which would secure efficiency and economy.

The report was adopted, and at an extraordinary general meeting the issue of the stock referred to above was approved.

South Metropolitan Electric Light & Power Co., Ltd.

For the year 1921 there is a credit balance of £100,315, plus £18,260 brought forward, and £1,001 the dividend of 10 per cent. per annum on the holding of shares in the West Kent Electric Co., Ltd., for 1920, making a total of £119,576. Debenture and other interest requires £16,754, 7 per cent. is paid on the 7 per cent. cumulative first preference, and 6 per cent. on the 6 per cent. cumulative second preference shares; £24,000 to depreciation fund; £25,000 to reserve; a dividend of 10 per cent. (less tax) on the ordinary shares for the year (£16,500); £21,498 is to be carried forward. Notwithstanding the unfavourable trade conditions, there has been a marked improvement in revenue, which is highly satisfactory. The business of the West Kent Electric Co., Ltd., has been adversely affected by the depression, but, as stated, a dividend of 10 per cent. is again recommended, and £5,000 has been placed to reserve account, against £8,000 last year. Sir Ernest V. Hiley, K.B.E., resigned from the board during the year, and Sir Edmund Wyldbore-Smith has been elected a director. Meeting: February 27th.

Charing Cross, West End and City Electricity Supply Co., Ltd.—A dividend on the ordinary share capital of the West End undertakings, for the half-year ended December 31st, 1921, at the rate of 6s. per share, is recommended, making, with the interim dividend, 9 per cent. for the year.

Northampton Electric Light and Power Co., Ltd.—In spite of trade depression the business was successful during 1921. Coal stocks were ample to maintain supply and new consumers came on owing to partial failure of other sources of power. This, combined with falling coal and other prices, resulted in increased profits, and enabled a reduction to be made in the price of energy. Lighting and heating have been added equivalent to 14,827 (32-watt) lamps, making a total of 140,961. The h.p. of motors has increased from 7,755 to 8,461, of which 4,835 is let out on hire. Units sold increased from 7,646,577 to 7,757,355. Good progress is being made with the extensions to the Hardingstone Junction generating station, and the new plant will be installed and running in a few months. The balance of £60,000 seven per cent. second debenture stock, offered at par, was all taken up. £19,681 has been added to depreciation fund (£1,681 allocated to motors). £7,000 has been added to the reserve fund, and £2,000 to the battery suspense fund. £500 has been put aside toward an employés' benevolent fund. A final dividend on the ordinary shares at the rate of 5½ per cent. makes 9 per cent. for the year, compared with 8 per cent. for 1920. £4,565 is carried forward.

Lancashire United Tramways Co.—According to the *Financial Times*, the profit for 1921, less working expenses, cost of generating electrical energy sold, general charges, and rent of leased lines, was £28,217. The receipts show a decrease of £14,881, and the expenditure an increase of £7,754. Interest and dividends from operating company, plus motor coach and sundry receipts, was £69,761. Deducting motor coach and other expenses and interest on prior lien debenture stock, there remains a balance out of which interest at 2½ per cent., less tax, will be paid on second mortgage debenture stock for the year, leaving £1,126 for depreciation. The balance on working the operating company, after payment of interest and dividend, was £10,248. Depreciation and renewal account (after writing off £5,000 for depreciation on motor coaches and omnibuses) and amounts carried forward in combined companies now amount to £183,642.

Tyneside Tramways and Tramroads Co.—Dr. J. T. Merz, presiding at the half-yearly meeting, held on the 14th inst., said that the working of the whole year had been most difficult, and the losses of traffic through the coal mines stoppage were most marked. The passengers were 50 per cent. less. For the whole year there had been a reduction of 6 per cent. compared with the previous year. They had taken out of reserve for rolling stock and permanent-way repairs £6,000; but, on the other hand, they had paid into that fund from the profits of the year £3,700, so that their reserve fund had only been reduced by about £3,000. The work on the permanent way had cost about £5,000. He regretted that the dividend was the smallest since 1912. As to the future there were slight signs of improvement. The first six weeks of this year were about on a level with last, and if that continued their position would be very much better.

Companies Struck off the Register.—The following companies have been struck off the Register and are thereby dissolved:—

Blackpool Electric Tramways (South), Ltd.
British Lamp Manufacturers, Ltd
Electric Generating Stations, Ltd.
Electromotor Equipment Co., Ltd.
Engineers' Standardised Publications Association, Ltd.
General Engineering Accessories, Ltd.
Murex Magnetic Co., Ltd.
Simplex Insulators (Bourke's Patent), Ltd.
Accessories Manufacturing Co., Ltd. (registered November 7th, 1910).
Anglo-Colonial Engineering Co., Ltd.

Llandudno and Colwyn Bay Electric Railway, Ltd.—The profit for the year ended November, 1921, after providing for debenture and loan interest, was £6,195, plus £2,548 brought forward. There is put to debenture stock redemption £2,040, and to reserve for repairs and renewals £2,500; a dividend of 4 per cent., less income tax, requires £2,783, leaving £1,420 to be carried forward. The summer receipts were affected by the coal strike and the restriction of electricity supply, but increased fares were in operation during the whole year, and satisfactorily increased the receipts. Expenses have been high, but they are now beginning to fall. Portions of the track require to be reconditioned and the work is in hand

Crossley Brothers, Ltd.—A loss of £94,016 is reported for the year 1921. The loss was due to the heavy fall in the value of stocks. The sum of £51,161 was brought forward, out of which the preference dividend was paid for the first half of the year and a payment made on account of corporation profits tax of £1,250, leaving a debit balance of £54,189, which is carried forward. For 1920 the profits amounted to £59,111 and 3 per cent. was paid on the ordinary shares.—*The Times.*

Kensington and Knightsbridge Electric Lighting Co., Ltd.—A dividend of 6 per cent. on the ordinary shares for the half-year ended December 31st, 1921, is recommended, making, with the interim dividend, 10 per cent. for the year.

Brompton & Kensington Electricity Supply Co., Ltd.—Final dividend at the rate of 15 per cent. per annum, making 12 per cent. for the year, less tax.

Westminster Electric Supply Corporation, Ltd.—The report states that during 1921 the connections increased from 56,652 kW to 59,132 kW. The units generated totalled 28,484,775, and there was sold to consumers and used on works 26,093,964, 1,742,854 being expended in distribution. The report contains the same remarks on the Electricity Supply Bill and the operations of the Electricity Commissioners as appeared in the report of the St. James' & Pall Mall Co. (ELEC. REV., February 17th, p. 242). A dividend at the rate of 12 per cent. per annum, less income tax, for the past half-year, making 10 per cent. for the year, is recommended, £7,324 remaining to be carried forward. Mr. J. Browne Martin has resigned from the board, and the directors express appreciation of his services since the formation of the company. Sir W. H. Porter has been elected a director. Meeting: March 1st.

Rushden and District Electric Supply Co., Ltd.—In spite of trade depression the output in 1921 was practically the same as in 1920. A full supply was maintained throughout the coal strike. Lighting and heating connections increased by 2,131 (32-watt) lamps (equiv.), making 9,483; motors increased from 761 h.p. to 776½ h.p. (292 on hire). £2,000 was added to depreciation, and the balance of preliminary expenses (£500) has been written off. Dividend for the year 7½ per cent., against 6½ per cent. in the previous year. £805 carried forward.

Chas. Clifford & Son, Ltd.—The works at Fazeley Street and Dog Pool were not fully employed during 1921 owing to trade depression throughout the world. Net profit, £8,041, which, with the balance brought forward, makes £28,212. After paying 6 per cent. per annum, less tax, on the preference shares, it is proposed to pay (in addition to the interim dividend already paid) six months' dividend on the ordinary shares (to December, 1921) at the rate of 10 per cent. per annum and a bonus of 5 per cent., both free of tax, leaving £19,041 to be carried forward.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 148a:—

Scottish Power Co.—200,000 8 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 200,000.

The undermentioned securities have been ordered to be officially quoted:—

Newcastle-upon-Tyne Electric Supply Co.—£750,000 6 per cent. second mortgage debenture stock.

Shropshire, Worcestershire and Staffordshire Electric Power Co.—£500,000 7½ per cent. 10-year guaranteed convertible debenture stock, 1921.

City of London Electric Lighting Co., Ltd.—The directors recommend dividends on the 6 per cent. cumulative preference shares and the 8 per cent. cumulative second preference shares, also 1s. 9.6d. per share on the ordinary shares, making, with the dividend paid in September, 14 per cent. for the year 1921. The dividends are subject to income tax.

Mersey Railway Co.—The revenue available for payment of interest in 1921 is £53,890, which is sufficient to meet the full amount of the interest on all the debenture stocks, and £207 is carried forward. In accordance with the directors' application to the Ministry of Transport, the railway was not included in the grouping arrangements provided under the Railways Act, 1921.

Prospectus.—*North Metropolitan Electric Power Supply Co.*—The prospectus has been before the public this week inviting subscriptions to an issue of £250,000 8 per cent. cum. second preference stock at par. The list was to close on or before to-day (Friday).

In actual fact the lists closed on Monday morning, but country applications were being considered early next day.

National Boiler and General Insurance Co., Ltd.—The directors report a net profit of £41,100 for 1921, and they recommend a final dividend of 20s. per share, less tax, making 32s. per share for the year, carrying forward £13,209.

Direct West India Cable Co., Ltd.—An interim dividend at the rate of 6 per cent. per annum, free of tax, on the ordinary shares is recommended for the half year.

Telegraph Construction and Maintenance Co., Ltd.—Final dividend of 7½ per cent., free of tax. An interim dividend of 2½ per cent. was paid in July.

Metropolitan Electric Supply Co., Ltd.—A final dividend of 5s. per share, making the total 7 per cent. for the year, is announced. £94,892 is put to depreciation and reserve and £3,609 is carried forward.

The Scottish Power Co.—A dividend of 7 per cent. on the ordinary shares is announced.

Aberdeen Suburban Tramways Co.—Profit for the past half year, £1,050, plus £2,293 brought forward.

W. T. Henley's Telegraph Works Co., Ltd.—Final dividend on the ordinary shares of 2s. per share, less tax, making 3s. for the year.

Fife Tramway, Light and Power Co., Ltd.—The profit for the year, after paying loan and debenture interest and redemption, is £58,088. After putting £17,000 to reserve, and paying the 6 per cent. preference interest and a dividend of 8 per cent., less tax, on the ordinary shares, £4,358 is to be carried forward. The revenue from traction, lighting, and power undertakings was £78,394, and the balance carried to net profit and loss account £72,824. The year's results were affected by the coal strike and trade disputes. Additional small sections of the tramway track were doubled during the year. The considerable extensions of the plant, &c., will be completed in the next few weeks, as a result of which the power station capacity will be increased substantially, and economies in operating costs effected. Since the close of the accounts an issue of £250,000 7 per cent. debenture stock at 93 per cent. has been made. The issue was largely oversubscribed.

Costa Rica Electric Light and Traction Co., Ltd.—The net earnings in Costa Rica during the year ended June, 1921, after charging all expenses, were £25,727, an increase of £1,208 over the previous year. The net profit of £3,709 wipes out last year's deficit and leaves a surplus of £3,379. £745 is written off discount and commission on debentures, and the remainder is carried forward. As foreshadowed at the general meeting last year, the first two deferred warrant issues amounting, with interest accrued, to £5,417, were paid on March 1st and July 1st last respectively. Owing to the unfavourable cash position caused by the loss in exchange, the incidence of the Corporation Profit Tax, heavy maintenance and renewals and other special expenses during the year, the directors do not see their way to a further payment on this account at the present time.

Woking Electric Supply Co., Ltd.—During 1921 the total revenue was £44,219, less expenses, £25,717, leaving £18,502, plus £1,201 brought forward. Debenture stock interest, £2,883, loan interest, £334. Dividends on the 6 per cent., 7 per cent., and 10 per cent. cumulative preference shares are to be paid; £6,000 is put to depreciation and renewals, and £2,000 to reserve. The dividend on the ordinary shares is to be 7 per cent., and £1,222 is to be carried forward. The number of consumers increased from 2,460 to 2,587; the lamps connected from 185,287 to 190,610, and the revenue from £43,681 to £44,219. The depreciation and renewals fund now stands at £30,383. Units generated fell from 2,771,743 in 1920 to 2,614,521 in 1921, and units sold from 2,239,759 in 1920 to 2,128,189 in 1921.

Mather & Platt, Ltd.—The dividend for 1921, as announced here last week, was 10 per cent. The figures now available show that the net profits at £379,480 were £144,269 better than in 1920 and £197,062 better than in 1919. After paying the dividend mentioned, £287,661 is to be carried forward, as against £105,456 brought in from 1920.

Traction and Power Securities Co., Ltd.—The directors recommend a final dividend at the rate of 4s. 6d. per share, free of tax, making 8s. per share, free of tax, carrying forward £14,136, subject to corporation tax.

Bruce Peebles & Co., Ltd.—The directors recommend the following dividends:—On the cumulative participating preference shares, 7½ per cent. and 2½ per cent. for the year; on the ordinary shares, 10 per cent. for the year and a bonus of 5 per cent.—all less tax.

Chelsea Electricity Supply Co., Ltd.—A dividend at the rate of 7 per cent. per annum on the ordinary shares for the half-year to December 31st, making 6 per cent. for the year, is announced.

Halifax and Bermudas Cable Co., Ltd.—An interim dividend at the rate of 6 per cent. per annum, free of tax, is recommended for the half year.

Victoria Falls and Transvaal Power Co.—The net earnings, including those of the Rand Mines Power Supply Co., for the quarter ended December 31st were £205,682, before providing for taxation.

STOCKS AND SHARES.

Tuesday Evening.

It was not until this (Tuesday) morning that any brake was put on the breathless rush which resulted in the War Loan and other gilt-edged stocks being run up in pyrotechnical fashion. The fall last Thursday in the Bank Rate to 4½ per cent. brought home, to the capitalist with money on deposit, that 2½ per cent. from the bank is hardly enough to receive on his money in days when living costs are still high. The immediate effect was to produce a boomlet in everything gilt-edged. Not only in the Consols list, however, has there been an outburst of strength. The movement extended to everything else of the investment type. For instance, the electricity debentures which have been issued during the past six months came in for eager attention, and as one example, it may be mentioned that the Reading Electric debenture stock has jumped to 8½ premium. Llanelly & District debenture is over 100, Midland Counties Electric debenture has gone up to 103½. The North Metropolitan issue of 8 per cent. preference stock at 100 achieved immediate success, the subscription lists closing within an hour of two of their opening. General Electric debenture is fully 104.

The Yorkshire Electric Power Co. is making an issue of £5 preference shares, as already mentioned, at £4 per share, and for the underwriting a lively competition took place. Writing in advance, it may be said that anticipation looked for the subscription lists to close almost as soon as they opened, for it was known that some, at any rate, of the underwriters want to take their stock firm. The company has just declared a dividend of 8 per cent. on the ordinary shares, for the third successive year, and the report shows a profit of £74,300, as against £64,700 for the previous twelvemonth. Business is tolerably active in the 8 per cent. preference shares of the Scottish Power Co., quoted at threepence either side of 20s.

Most of the electricity supply companies have now announced their final dividends for 1921. It may be convenient to set these out in a short table:—

Company.	Div.	Year.
Charing Cross Electric	6 %	9 %
Chelsea Electric	7 %	6 %
City of London Electric... ...	1s. 9·6d.	14 %
County of London Electric ...	11 %	8 %
Kensington and Knightsbridge...	6 %	10 %
London Electric Supply... ...	4 %	4 %
London Suburban Traction ...	5 % Pref.	3½ % (arrears)
North Metropolitan Electric ...	10 %	10 %
St. James's and Pall Mall ...	8s. 6d.	12 %
Scottish Power Co.	7 %	7 %
Smithfield Markets Electric ...	5 %	5 %
Westminster Electric	12 %	10 %
Yorkshire Electric Power ...	5 %	8 %

The County of London puts by £180,000 to reserve, as against £112,500 in the previous twelve months. The London Electric's 4 per cent. goes against 2½ per cent. a year ago. The Charing Cross dividend, making 9 per cent., is one per cent. up, and the Kensington and Knightsbridge, with its 10 per cent. for the year, increases its dividend similarly. The London & Suburban Traction's 3½ per cent. is in respect of arrears on the 5 per cent. preference shares, and the North Metropolitan Electric dividend of 10 per cent. is 2½ per cent. better. The rest of the dividends are the same as those of the previous year. The effect upon the share market has been to strengthen still further an already firm list. Shares are difficult to obtain, though we have said this so frequently of late that it tends to become a matter of monotonous reiteration.

Home Railway stocks have been booming. The reduction in the Bank Rate led to immediate attention being directed to the list of Home Railway ordinary stocks. Rises of 3 to 7 points per diem in the leading issues are nothing uncommon. The Underground group is moving with the rest, though not so quickly. Underground incomes are 5 higher. Metropolitans gained 4 points; Districts 2½. The Brighton Company's scheme for electrification has been, of course, postponed, but with money becoming cheaper almost every month, and with the public in its present temper of willingness to lend capital on any sound security, the probabilities point to the leading lines takings this opportunity for increasng their capital with the intention of spending the money upon electrification schemes.

Amongst other investment stocks, the cable group stands out with prominence. Eastern ordinary has risen 6½ to 176½, and the other trio, Globes, Westerns and Eastern Extensions are all substantially better on the week. The fact of the dividends being paid free of tax is again brought forward as a reason why this quartette is being favoured, though obviously, the argument loses part of its force in view of the possibility—we fear it is only such— of the Income Tax being reduced to 5s. in the £ in the next Budget. Great Northerns and Indo-Europeans are both £1 higher. Anglo-American Telegraph deferred at 95 is 3½ up. The wireless group is quiet, with Marconis a shade firmer and marines better at 24s. 6d. Canadian Marconis improved to 8s. 6d. Radios, however, are quiescent at 17s. 6d. for the common and 12s. 9d. the preferred.

Amongst other rises which have taken place in the manufacturing group are those of £1 in Telegraph Constructions, and smaller advances in Callenders, English Electric, General Electric and Henleys. Babcock & Wilcox at 2 11/16 are 3s. 9d. better. Edmundsons preference rose to 2. The provincial electricity supply group is strong, with Bournemouths 7½. Oxford preference 3½, Newcastle-on-Tyne second debenture several points higher at 92, and, in the colonial group, Melbourne Electric ordinary, 7 points up at 132. North Metropolitan preference, on the success of the new issue, advanced

to 17s. 6d. Urban preference are better at 35s. County of London debenture stocks advanced to 76 and 74¼ for the 1st and 2nd respectively, but there is very little stock on offer in either case.

A number of improvements have occurred in the list of home electricity shares. Charing Cross ordinary secured the biggest rise, and are 15s. higher at 5¾. County preference put on 12s. 6d., to 9. Kensingtons at 5¼, are 7s. 6d. up, London Electric preference at 3¾ are again 5s. higher, and smaller rises have occurred in others of this group.

British Columbia Electric Railway stocks have come into more attention, as they deserve to do, on the recent dividend announcement. Rises range from 1 to 3 points. In Mexicans there is nothing much doing, but Brazil Tractions at 36 show a gain of 2. The Anglo-Argentine issues are steady. Iron and steel shares are firmer, in sympathy with the general improvement that has taken place in most shares, with Vickers tax-free preference a good spot at 13s. 3d. The rubber market continues to be the Cinderella of the Stock Exchange, flatness of the produce giving rise to floods of talk which fails to exercise any beneficial effect upon the root of the trouble.

It may be pointed out that of the 70 stocks and shares quoted in our table, 36 claim rises this week. Not "Moderate" improvements, all of them: many are remarkably good. It is years since our price-lists have made such an extraordinary showing. For the principle reason, the explanation lies in the Bank Rate's reduction. But the student looks further than this, and knows that the day of readjustment of values is at last here. There are plenty of pitfalls being laid for the investor. Caution and discrimination, especially amongst new issues, are as needful as ever. The war, however, is over: that is the main factor which stands silhouetted amongst the hundreds of rises which are taking place every day in the investment markets of the Stock Exchange.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1919.	Dividend. 1920.	Price Feb. 21, 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	6⅞	—	£8 17 10
Charing Cross Ordinary	7	8	5¾	+ ¾	8 0 0
do. do. do. 4½ Pref.	4½	4½	8½	—	6 18 6
Chelsea	4	6	8½	—	7 14 10
City of London	18	14	1⅝	—	9 6 8
do. do. 6 per cent. Pref.	6	6	19/-	—	6 6 4
County of London	8	8	9¼	+ ⅛	8 2 2
do. do. 5 per cent. Pref.	6	6	9	+ ⅛	6 13 4
Kensington Ordinary	7	9	5¼	+ ¾	8 10 2
London Electric	2½	2½	1 1/16	—	8 7 6
do. do. 6 per cent. Pref.	6	6	8⅝	+ ½	8 0 0
Metropolitan	6	7	4⅜	—	8 0 0
do. 4½ per cent. Pref.	4½	4½	3 5/16	+ ⅛	6 15 4
St. James' and Pall Mall	12	12	7⅜	+ ½	8 8 6
South London	6	7	2½	—	10 9 0
South Metropolitan Pref.	7	7	1 5/16	—	6 11 8
Westminster Ordinary	10	10	6½	—	7 13 10
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	95	+3½	6 6 2
do. Def.	1½	1½	19½	+ ⅛	9 3 0
Chile Telephone	6	6	5½	—	5 14 3
Cuba Sub. Ord.	7	7	7⅜	—	9 6 8
Eastern Extension	10	10	177/-	+ ¾	5 12 8
Eastern Tel. Ord.	10	10	176/-	+6	5 13 4
Globe Tel. and T. Ord.	10	10	17⅜	+ ¾	5 13 8
do. do. Pref.	6	6	10	—	6 0 0
Great Northern Tel.	22	24	28	+1	8 11 6
Indo-European	10	10	33	+1	7 11 6
Marconi	25	15	1½	—	8 17 10
Oriental Telephone Ord.	12	12	2	—	*6 0 0
United R. Plate Tel.	8	8	6½	+ 5/16	*6 3 1
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	17½	+ ⅜	*5 12 0
Home Rails.					
Central London Ord. Assented	4	4	80½	+2¼	6 14 6
Metropolitan	1½	1½	35¾	+4	6 6 9
do. District	Nil	Nil	26	+2¼	3 17 0
Underground Electric Ordinary	Nil	Nil	2½	+ ⅜	Nil
do. do. "A"	Nil	Nil	6/6	+1/6	Nil
do. do. Income	4	2	77½	+5	*5 3 4
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	2⅛	—	9 15 6
do. do. 2nd Pref.	Nil	5½	3½	—	8 19 6
do. do. 5 per cent. Deb.	5	5	72½	+1	6 19 0
Brazil Tractions	Nil	Nil	36	+2	Nil
British Columbia Elec. Rly. Pfds.	5	5	68½	+1	7 17 6
do. do. Preferred	5	9/-	69½	+1	*7 14 2
do. do. Deferred	8	12½/-	63½	+3	*9 15 6
do. do. Deb.	4½	4½	64½	+1	6 11 9
Mexico Trams. 5 per cent. Bonds	Nil	Nil	59½	—	—
do. do. 6 per cent. Bonds	Nil	Nil	28½	—	Nil
Mexican Light Common	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	35¾	—1	Nil
do. 1st Bonds	Nil	5	68½	+1	7 17 6
Manufacturing Companies.					
Babcock & Wilcox	15	15	21⅛	— 1/16	5 19 0
British Aluminium Ord.	10	10	16/6	—	—
British Insulated Ord.	15	15	14½	—	8 17 10
Callenders	15	15	1 1/16	+ 1/16	9 12 0
6½ Pref.	6½	6½	18/9	—	6 18 8
Crompton Ord.	10	10	18/9	—	14 11 0
Edison-Swan	10	—	4/-	—6d.	—
do. do. 5 per cent. Deb.	5	5	62	—	8 1 4
Electric Construction	10	10	18/9	—	10 13 4
English Electric	8	8	10/-	+6d.	16 0 0
do. Pref.	6	6	12/6	—	9 12 0
Gen. Elec. Pref.	6½	6½	19/3	+6d.	6 15 1
do. Ord.	10	10	20/6	+3d.	9 17 8
Henley	15	15	22/6	+6d.	9 4 8
do. 4½ Pref.	4½	4½	8½	—	6 0 0
India-Rubber	10	—	⅛	—	—
Met.-Vickers Pref.	8	8	1⅛	—	8 10 8
Siemens Ord.	10	10	23/-	—	*8 18 10
Telegraph Con.	20	20	24	+1	*5 0 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances

Wednesday, February 22nd.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic per lb.	8d.	..
a Ammoniac Sal per ton	£65	..
a Ammonia, Muriate (large crystal) "	£58	..
a Bisulphide of Carbon	..	..
a Borax "	£31	..
a Copper Sulphate "	£29	..
a Potash, Chlorate per lb.	5d. to 5½d.	..
a " Perchlorate "	7½d.	..
a Shellac per cwt	£16 10s.	..
a Sulphur, Sublimed Flowers "	£13 10s.	..
a " Lump "	£12 10s.	..
a Soda, Chlorate per lb.	3½d.	..
a " Crystals per ton	£7	..
a Sodium Bichromate, casks per lb.	7½d.	..
METALS, &c.		
b Aluminium, Ingots per ton	£120	..
b " Wire per lb.	1/9 to 2/6	..
b " Sheet "	1/6 to 2/-	..
p Babbitt's Metal and Anti-friction Metal—		
Grade I per ton net	£147	..
Grade II "	£106	..
Grade III "	£62	..
c Brass (rolled metal 2" to 12" basis) per lb.	9½d.	¼d. dec.
c " Tubes (solid drawn) "	11¾d. to 1/-	¼d. dec.
c " Wire, basis "	10¾d.	¼d. dec.
c Copper Tubes (solid drawn) "	1/1½	¼d. dec.
c " Bars (best selected) per ton	£90	£4 dec.
c " Sheet "	£90	£4 dec.
c " Rod "	£90	£4 dec.
d " (Electrolytic) Bars "	£68 10s.	75/- dec.
d " " Sheets "	£145 10s.	..
d " " Wire Rods "	£85 10s.	5/- dec.
d " " H.C. Wire per lb.	10½d.	¼d. dec.
f Ebonite Rod	5/6	..
f " Sheet	5/-	..
a German Silver Wire	2/9	..
h Gutta-percha, fine	12/6	..
h India-rubber, Para fine	11¼d.	..
f Iron Pig (Cleveland Warrants) per ton	Nom.	..
f " Wire, galv. No. 8, P.O. qual. "	£27	..
g Lead, English Pig per ton	£21	30/- dec.
g Mercury per bot.	£11 to £11 5s.	5/- dec.
e Mica (in original cases) small per lb.	8d. to 8/-	..
e " " " medium "	4/- to 8/-	..
e " " " large "	10/- to 20/- & up	..
p Phosphor Bronze, plain castings "	1/1	1d. dec.
p " " drawn bars and rods "	1/3½	½d. dec.
p " " rolled strip & sheet "	1/3½	½d. dec.
p " " Wire "	1/3	½d. dec.
e Platinum per oz.	£24	..
d Suicium Bronze Wire per lb.	1/2½	..
r Steel, Magnet, in bars	1/-	8d. dec.
a Tin, Block (English) per ton	£139 10s. to £140	£15 10-£16 dec
a " Wire, Nos. 1 to 18 per lb.	8/3	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
j Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Non-Ferrous Metals Research.—The annual report of the British Non-Ferrous Metals Research Association for 1921 has recently been issued, and shows a gratifying record of progress achieved during the year. Apart from the researches of chief interest to those in the non-ferrous metal industry, even to those possessing small foundries, such as the investigations on brass casting and on the electrical melting of non-ferrous metals, a number of investigations are in progress of particular interest to electrical manufacturers, notably those on metal polishing and grinding, the jointing of metals, including soldering, brazing, and welding, the last-named being conducted by the Metropolitan-Vickers Electrical Co. Of fundamental importance is the investigation being conducted by Dr. W. Rosenhain, at the National Physical Laboratory, on the influence of impurities up to 1 per cent. on the working properties of copper. The increased speeds and stresses in modern electrical apparatus are such as to render increased knowledge of non-ferrous metals and alloys of enormous importance to electrical manufacturers.

Metric Gallons.—Having regard to the confusion which now exists, especially in overseas trade, due to the difference between the American gallon and the Imperial gallon, it has been suggested that it is desirable that an agreement should be reached between the Governments of Britain and America to the effect that as an alternative to either of the above gallons being adopted by both countries as a common standard, each of them should forthwith adopt the litre, which could be described as the "metric gallon." It is obvious that uniformity of practice in a matter of this kind is most desirable, and the adoption of the metric gallon would standardise practice not only between Britain and America, but also with practically all other countries engaged in international trade.

THE BRITISH INDUSTRIES FAIR.

On Monday next the third British Industries Fair opens simultaneously at London and Birmingham.

The London section, housed at the White City, is, from an engineering and electrical point of view, the less important, but many of the "sundries" of the trade will be exhibited there, as, for instance, all kinds of glassware, china, and earthenware, as well as numerous scientific instruments, chemicals, and photographic and kinematographic apparatus. This section is under the control of the Department of Overseas Trade.

The Birmingham section, which occupies the extensive aerodrome buildings at Castle Bromwich, has been organised by the Municipality and the Chamber of Commerce. Last year about 130 firms connected with the electrical and allied industries were present, and a large number of these have taken space again this year. So far as possible the firms are grouped according to the nature of their exhibits to facilitate the comparison of similar products by different firms. The principal groups into which this section of the Fair is divided are:—Brass foundry, hardware, and ironmongery; metals; construction, building, and decoration; power, lighting, cooking, heating, and ventilating; engineering; agriculture; mining; and motors, motor-cycles, cycles, and accessories.

This year's Fair will be divided into two sections only instead of three as last year, the attendance at the Glasgow (textiles) section having been considered insufficient to justify its continuance.

Birmingham Section.

The Premier Electric Welding Co., Ltd., has a display of welding plant designed for special applications. The 4.4-kW set, illustrated in fig. 1, is one of the principal exhibits. This is a portable set consisting of a "Gardner" 10-h.p., two-cylinder, water-cooled engine, running at 1,200 r.p.m., and designed expressly for this purpose, direct-coupled to a special compound-wound generator, rated at 4.4 kW. This machine has three field windings—shunt, series, and a third winding supplied from a separate exciter, and it possesses a "drooping" characteristic by which as soon as the welding operation commences the voltage, which on open circuit is 60, automatically drops to that required by the operator—from

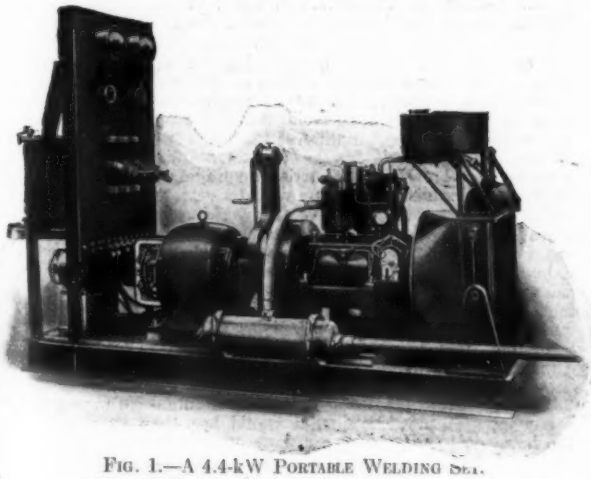


Fig. 1.—A 4.4-kW Portable Welding Set.

20 to 30 V. This has rendered possible a considerable reduction in the size of the equipment. The exciter is a .13-kW machine, and is mounted on the generator shaft. The generator is connected with the arc through reactance coils in the main circuit; these coils absorb practically no energy but have a marked effect upon the efficiency of the welding operations. The amount of reactance is varied by means of a triple-pole switch mounted on a well-finished switchboard. The overall dimensions of the plant are: length 8 ft. 9 in., width 3 ft., and height 6 ft., and the total weight is about 25 cwt. The company also shows a motor-generator plant for tramway work, consisting of a d.c. motor coupled to a welding generator similar to that described above. The plant is totally enclosed in a sheet steel housing. An equipment for use in workshops where existing shafting can be employed is exhibited, and in addition to this there is an a.c. transformer plant of small weight, also for use in workshops. The exhibit is completed by a selection of electrodes of many types, including cast-iron, manganese steel, and high-carbon steel. A spot welding machine of standard design also appears upon the stand.

Messrs. Gent & Co., Ltd., have an exhibit comprised of numerous small commercial and industrial appliances. Chief among these are examples of their "Pulsynetic" time system, consisting of a master clock controlling a number of secondary clocks of various sizes. Other accessories of this system include mechanism for driving turret-clock dials on the "waiting-train" principle; automatic sounders for giving warnings at pre-determined times; and the "Reflex" pendulum control for unifying the times registered by a number of workmen's time recorders in a factory. Several types of telephone are shown including "Parsons-Sloper" secret interphones, intercommunication sets, and special ironclad flameproof telephones for use in mines. Switchboards and annunciators also appear. Examples of water level alarms, indicators, and recorders, operated electrically, are exhibited. The sound signal apparatus displayed includes a number of ironclad bells, passed by the Home Office for use in fiery mines. There also samples of motor-driven sirens ranging from ¼ h.p. to 6 or 8 h.p.; relays for battery and power circuits; navigation light indicators; mining shaft signal apparatus; ironclad junction boxes; and machines for recording the time lost by stationary machinery.

The Neale Magnet Construction Co., Ltd., exhibits the "Kendrick" inspection lamp. This appliance consists of a lamp with a base containing an exposed electromagnet which enables the lamp to be attached to any steel or iron surface. It is particularly suited for the examination of the internal mechanism of automobiles, leaving both hands free to make adjustments. It is made in two styles—a low-pressure (6 or 12 V) type for cars, and a larger size suitable for use on the lighting circuits of garages, 100-120 V or 200-250 V, d.c. The smaller type has a push switch to cut out the magnetising current without extinguishing the lamp.

Fuller's United Electric Works, Ltd., exhibits a large range of accumulators and accumulator components, including special types (plate and block patterns) for automobiles, train-lighting, telephone and telegraph work, and for aeroplanes. Numerous dry and inert cells are shown in addition. The firm also displays miners' lamps and accessories, including charging racks, lamp stands, opening magnets, &c. The "Fuller" lamp weighs only 5 lb. and gives 12 hours' service on one charge. Another feature of this stand is a number of samples of wires and cables. Among these are bitumen-insulated cables, wire-armoured, colliery, vulcanised rubber, lead-covered, c.t.s., and telephone cables. Ebonite in various forms is exhibited, there being tubes, rods, bushes, washers, terminal blocks, switches, boxes, separators, &c.

Messrs. W. Canning & Co., Ltd., show low-voltage dynamos and motor-generator sets for electro-deposition work, and also a variety of accessories such as plating vats and barrels; and copper, nickel, silver, and gold salts. Besides these there are polishing and grinding motors, and a number of small belt-driven lathes.

The Electro-Mechanical Brake Co., Ltd., has an exhibit consisting of many examples of controllers and grid-type resistances. A range of steel-cased drum-type controllers for dealing with loads of from 5 to 100 h.p. are included. A special feature of these is the ease with which the drum can be withdrawn by simply loosening back four bolts. There is ample space for cables and entry at the back, side, or bottom of the controller can be arranged. For ships' winches a special water-tight design has been produced. The "Midget" controllers shown are similar in some points of construction to the larger type, but are for single pole only and suitable for series motors, being especially adapted to the control of hoists, wall cranes, pulley blocks, or telphers. The frame consists of two cast-iron end plates supported by mild steel bars; the cover is of heavy-gauge sheet steel, and is secured in position by substantial quick-releasing latches. As in the large controller, arc shields are fitted between all contact fingers. These shields are mounted on a pivoted arm allowing the whole to be swung out. The drum consists of a series of cast-iron sections clamped to a square mild-steel shaft and insulated from it by mica. The drum contacts are of hard-drawn copper, fastened to the drum casting by countersunk headed screws, permitting easy replacement. A number of jointless and rustless grid resistances of various sizes are shown. These are made of wire of uniform cross-section and continuous length, with a temperature coefficient and current-carrying capacity similar to those of cast-iron. The insulation is mica and micanite, tested to 3,000 V, a.c. Resistances designed for special purposes such as battery-charging, locomotives, traction, and kinema-regulating are also exhibited. On another stand the firm shows gears, forgings, and other general engineering material.

Messrs. A. Reyrolle & Co., Ltd., have as their principal exhibit three types of their armoured, draw-out switchgear. One is an electrically-operated generator panel, and there are two armoured panels designed for use in fiery mines, mounted on substantial cast-iron pillars. Other colliery gear shown includes a flame-proof drum-type motor starter (fig. 2), of the firm's latest pattern. This is fitted with a double-pole circuit breaker, interlocked with a starting rheostat automatically controlled. No-voltage and adjustable overload releases are fitted, and a magnetic blow-out is fixed on the first contact. A push-button operates an instantaneous stopping motion. A wide machined joint prevents the emission of flame in the event of an explosion. Flame-proof oil-break switches form another part of the exhibit. For the rest the display consists of air-break switches; porcelain-handle fuses of various types and sizes; cast-iron distribution boxes, arranged for any number of "ways" up to nine; ironclad single-pole fuses, of 50- and 100-A capacities; drum-type starters, combined with shunt regulators, for industrial purposes; and a variety of earthed wall plugs for domestic and industrial use.

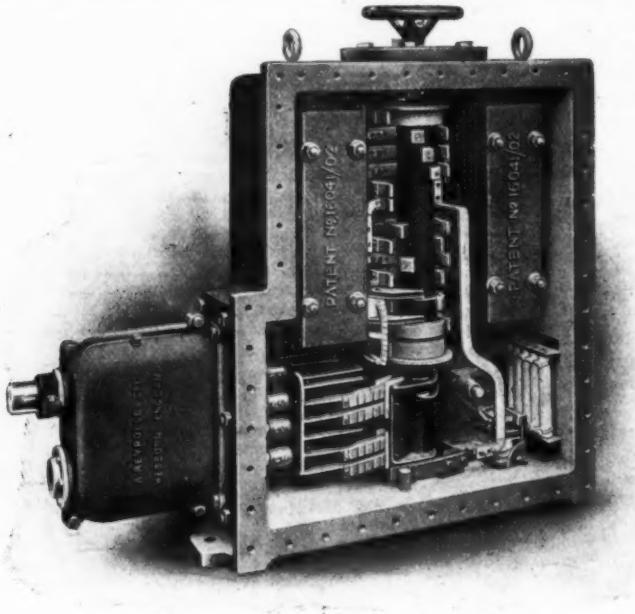


Fig. 2.—Colliery Drum-type Motor Starter.

(To be continued.)

THE POST OFFICE ENGINEERING DEPARTMENT.

Annual Dinner.

The annual dinner of the Post Office Engineering Department took place at the Connaught Rooms on February 17th, under the chairmanship of Sir William Noble, engineer-in-chief of the department, when a large assembly of members of the staff and distinguished guests thoroughly enjoyed a most successful function. The Dinner Committee is to be congratulated on the success of its plans, as is also Mr. Philip Henry, L.R.A.M., under whose direction an excellent programme of music was rendered by Miss Sybil Elliott and Messrs. Frank Thorne, Robert Pitt, and Langton Marks.

Following the loyal toast, which was proposed by the chairman, the Rt. Hon. H. Pike Pease, M.P., Assistant Postmaster-General, in the unavoidable absence of the Postmaster-General, the Rt. Hon. F. G. Kellaway, M.P., proposed the toast of "The Post Office Engineering Department," and in the course of his remarks expressed the opinion that cheap communication was more valuable to the State than some business people seemed to think. The Post Office staff numbered 227,000 persons, and as many as 6,000 million separate postal packets had been handled in one year; it was, therefore, not surprising that some errors were made.

He congratulated the engineers on their accomplishments during the past year; good progress continued to be made with the main underground work. During the past year 720 miles of single duct was laid, and 116,730 miles of double wire drawn in. Numerous new cables between large towns had been brought into use since March 31st last, and many others were in course of construction. In connection with the extension of local telephone facilities, approximately 1,000 miles of single-way duct was laid and about 100,000 miles of double wire drawn in. About 500 overhead trunk telephone circuits were provided, involving the erection of approximately 10,000 miles of double wire, and in addition to a large number of minor exchanges 22 new manual exchanges were opened in the United Kingdom during 1921, providing accommodation for approximately 33,000 subscribers; extensions to 17 existing large manual exchanges were also completed, affording accommodation for over 12,000 additional subscribers. Also 11 new exchanges and 13 extensions were ordered during the year; those would in due course provide for a further 16,000 lines.

Amongst the new exchanges opened was a London "Toll" exchange.*

Although no large automatic exchanges had been opened during the past year, the introduction of automatic working had been decided upon in several areas and many of those schemes were well on the way to fruition. Orders had been placed for six new exchanges having a total initial equipment exceeding 11,000 lines and for extensions totalling 3,500 lines at four existing exchanges; some of the latter were on the point of completion.

Developments had been proceeding with the design of small unattended automatic exchanges and two such exchanges were opened towards the end of the year at Ramsey and Hurley. Those exchanges presented several new features occasioned by the special conditions they were required to meet. The absence of a public power supply in the neighbourhood involved the design of apparatus for the provision and control of power and the fact that the exchanges were normally unattended led to the installation of special alarm circuits for bringing faults to notice at a distant point where staff was in attendance. Mr. Pike Pease compared the fault statistics for the local telephone exchange system of the United Kingdom for the year ended December 31st, 1921, with those for the two previous years—basing his statements on the fault returns in respect of 805,000 stations during 1919; 879,000 during 1920; and 924,000 during 1921—and showed that the total faults per annum per station were 2.25 in 1919; 2.09 in 1920; and 1.72 in 1921, representing an improvement during 1921, as compared with 1919, of 23.6 per cent. and between 1921 and 1920 of 17.7 per cent. The average duration per fault in hours was 9.1 in 1919; 6.1 in 1920; and 3.8 in 1921; which figures represented an improvement during 1921, as compared with 1919, of 58.25 per cent. and between 1921 and 1920 of 37.7 per cent.

The chief feature, he said, of telegraph development was the large extension of machine printing apparatus, mainly Baudot duplex, as follows:—Two triple duplex Baudot sets on the London to Amsterdam circuits; 16 quadruple duplex Baudot sets on London and provincial circuits; 20 quadruple duplex Baudot sets on inter-provincial circuits.

They were thus gradually relieving the operators of the laborious and nerve-racking system of Morse sending and receiving by substituting the use of mechanical means, which could be learnt easily and, incidentally, gave greater accuracy and more expeditious handling of telegraph traffic. The speed of the Imperial cable in the westward direction had been improved by the use of a Heurtley magnifier at Halifax, Nova Scotia. The provision of a new repeater station at North Walsham, Norfolk, would improve the working conditions of the repeaters used on the German cables. The extended use of the Post Office "G" relay had enabled additional circuits to be worked without the use of repeaters, thereby saving considerable expense both in first cost and maintenance. A new method of "automatic through switching" of telegraph circuits, based on the same principles as automatic telephone switching, was being developed and promised good results. The use of secondary cells in place of primary batteries had been considerably extended with a resultant saving in maintenance costs and greater security of working. No man could say what future achievements would be; they must expect the impossible:

> "Got any rivers you say are uncrossable,
> Got any mountains you can't tunnel through;
> We specialise in the wholly impossible,
> Doing the things that no man can do."

The chairman, Sir W. Noble, responded, and was glad to be able to announce that this year more raw materials were available, prices had fallen, and delivery dates were shorter, which improved the working conditions, but unfortunately work had fallen off. The telephone service depended on trade prosperity; he was hopeful of trade reviving and the telephone service would revive with it. Economy committees might save as many millions as they liked from non-revenue-earning departments, but he hoped they would keep their hands off the revenue departments. They had never had a chance in this

* Elec. Rev., September 16th, 1921; p. 371.

country of bringing the telephone service up to date, and there was now an excellent opportunity, now that trade was bad, of bringing the local and trunk systems right up to date, so that when trade did revive no business would have to wait weeks for telephones, and he hoped there would be no cutting down of their programme for next year. Major T. F. Purves proposed "The Visitors" in a humorously appreciative speech; one thing, he said, that the Post Office Engineering Department was proud of was the calibre of their friends who honoured them on such occasions as that. He thanked the president of the Institution of Electrical Engineers (Mr. J. S. Highfield), and the past-presidents who were present (Mr. Ll. B. Atkinson, Mr. C. H. Wordingham, C.B.E., and Sir John Snell) for obtaining a charter for the Institution and thus securing that status which its members deserved. Incidentally, Major Purves mentioned that Mr. J. L. Macquarrie (a high official of the U.S.A. telephone service) had recently had an opportunity of trying the new high-frequency carrier-current circuit that had been installed between London and Bristol, which was giving excellent results.

Sir John Snell, in reply to the toast, said: "How little does the public and Press really know of the true position of the telephone service!" It was only natural that when a company knew that its undertaking was to be sold, it would not spend more than it was obliged to spend. When the P.O. took over the service, therefore (Sir John himself had been partly responsible for the terms of that transfer), it was obliged to spend much money on making up the lee-way; unfortunately, the war intervened and but for that fact the arrears of work would have been made up long ere this he felt sure. As an Electricity Commissioner, Sir John felt that he would in future be continually brought in contact with the Post Office; he hoped it would allow them a little space under the pavements and in the air for their transmission lines, because he felt that it was to those electricity distributing lines that the Post Office would have to look in the future for the power that would be needed for some of its developments. Concerning automatic telephony, his opinion was that the use of automatic exchanges would give the greatest benefits and economies not so much in large cities and densely populated areas, as in the rural districts.

Sir. Evelyn P. Murray, K.C.B., secretary to the P.O., proposed "The Chairman" which toast was accorded musical honours, and in his reply, Sir W. Noble endorsed the proposer's remark that he had done nothing to obstruct the work of the department. Every business had to have a general manager, said Sir William, and no department interfered less with the engineering work than the secretariat. They always got what they wanted because they never put forward mad-cap schemes and always gave very good reasons for their proposals. The secretary only acted in an administrative capacity, and did so well, said Sir William, who concluded by paying a tribute to the hard work and loyal support of his staff.

THE SELLING OF ELECTRIC LIGHT.

At the fourth E.D.A. Salesmanship Conference on February 17th, Mr. Haydn T. Harrison read a paper on "Salesmanship in Relation to Electric Lighting." Mr. J. W. Beauchamp, director of the E.D.A., presided in the absence of Mr. S. T. Allen.

Mr. Haydn Harrison said that creating a market for anything was generally done by making people dissatisfied with what they had got. Even now, however, electric light was far from universal, which was nearly always due to the initial expense, and this should be, therefore, the first line of attack in order to gain business. If the supply authorities had the powers or the means they would probably go in for free wiring and prepayment meters, but this was seldom the case, and the salesman must find some other way of circumventing the difficulty. If houses were plentiful, there was little doubt that tenants would choose those houses with electric light, and landlords would be forced to wire the remainder in order to retain their tenants. But, the opposite being the case, the landlord was the man to be tackled. He complained that he was not earning enough on his investment, which was often true, but if he could be persuaded that by spending the necessary capital to wire the house, and increasing the rent to that which the tenant was prepared to pay under those conditions, he would increase the all-round interest. Having persuaded the landlord of the advisability of the expenditure, it was necessary to persuade the tenant that the extra rent was justified. This was not difficult if the tenant were dissatisfied with his existing lighting, compared with that of a neighbour who had electric light. In order to ensure that electric light produced a bright and pleasant result it was necessary to do some thing more than fix a few electric lamps. It should be the endeavour to obtain a low intrinsic brilliance which gladdened the eye when looking at the light source, and yet produced a light which tended to make every occupation a pleasure. The present type of gasfilled lamp with an opal glass bulb, was a step in the right direction. There were other means of obtaining a bright effect, such as opal or similar glass shades and globes of the right material and area. He particularly warned his audience against using a shade too large for the power of the lamp, because the bright appearance would immediately disappear, though the lighting were ample. He also warned them against the use of indirect and semi-indirect fittings, consisting of alabaster or other bowls, unless the cost of electrical energy was of no importance. The "Denzar" fitting, used in America, was perhaps the most suitable for nearly all purposes. In this the lower hemisphere was of relatively small diameter opal or similar glass. It had a wide clear glass flange, by which it was coupled to the top reflector, also of opal, thus leaving enough top illumination to be pleasant, and reflecting the balance on the working plane. It formed a complete enclosing globe of sufficient area to ensure ample cooling surface, and required practically no internal cleaning. Such lighting fixtures should be encouraged, because they could be used with lamps of high power, so that an ordinary room only required one lamp. Mr. Harrison was in favour of the introduction of a few good standard designs. A salesman should know what he was selling, and a man selling a few lines, or even one article, of which he knew the capabilities, was in a better position to do good than the man who brought a hundred and one things to the notice of a customer, and knew little about them. The chief difficulty, however, was to turn scientific facts into talking points, to create the electrical idea, and the E.D.A. had done much towards this end by supplying pamphlets pointing out in brief and attractive language some of the most salient points. It was better to talk of the average cost of an electric lamp per annum than of the total cost of an installation. Mr. Harrison then referred to the difficulties experienced by salesmen with regard to the power of lamps required. Such terms as candle-power, lumens, foot-candles, &c., were bandied about in a most careless way by many people who had not investigated what they really meant. Therefore, he preferred to use the formula favoured by medical men, "to be taken as required." It was worth while for an electric light representative to study decorations, and the influence of light and colours upon them. Other valuable selling points included the saving in cost of decorating and cleaning, purity of atmosphere, and convenience. But all these advantages required to be inculcated by literature or word of mouth, whereas light and brightness spoke for themselves.

Mr. Rawlings, opening the subsequent discussion, said he could not quite see how a standard fitting could be adopted which would suit all conditions. The contractor had to put in, not what he wanted, but what the customers wanted, although, of course, he could help to steer them along the right course. If salesmen were a little more careful in advising their clients of the defects as well as the advantages of lamps it would be better. Mr. Rawlings also said something should be done by the supply authorities to develop means of supplying small houses; until that was done, the contractors could not get consumers for them. They should adopt some such system as that used by the Fixed Price Light Co.

Mr. Simon agreed with Mr. Harrison as to standardising fittings, and blamed the manufacturers for putting so many types on the market, and constantly changing them. Dealing with advertising, Mr. Simon criticised the practice of lamp manufacturers of advertising so extensively their own individual lamps. Valuable space was occupied in that way; it was natural that manufacturers should want to advertise their own goods, but why should not that space be used for educating the public on the advantages of electric lighting? The writing of non-technical articles on electricity in the daily Press would help a great deal. Finally, he suggested that some unit of lighting should be introduced which would be understood by customers, say, a certain light for reading, &c.

Mr. Stephens said that in towns and villages in this country which had a supply of both gas and electric light, about 92 per cent. of the people used gas, and there was a tremendous field before the electrical industry. The number of installations in this country during the last ten years had not kept pace with the development in the art of lighting, and the improvements made in fittings, &c., by the manufacturers.

Mr. Campbell dealt with educational work, and blamed the central station people for not approaching consumers. Indeed, the average consumer was not served properly by any branch of the industry, with regard to improving his lighting. One of the greatest difficulties to be contended with was the lack of effort and co-operation between all branches of the industry.

Mr. Rogers dealt with the point that central station people did not approach their consumers. Speaking as a supply station man, he could say that as a rule the supply stations were condemned for suggesting anything of the sort. If they went in for special showrooms, with special types of lighting, where was the money coming from?

Mr. Mayo called attention to the very slight inconvenience caused by the installation of electric lighting in a home, and that was a good selling point. The right men should be chosen to do the job, those who would study the convenience of the occupants.

Mr. Falk, referring to Mr. Campbell's remarks, said it was all very well to tell a consumer that his lighting was all wrong, but the difficulty was that of expense; he could not always afford new fittings, and he would point to the fact

that his fittings were not worn out. One of the advantages of electric fittings was that they lasted for ever. Until the supply companies could get a supply into a house cheaply, there would not be much improvement, in his opinion.

Mr. Williams asked that British makers of electrical equipment should adopt more system in their manufacture, and so bring the prices down.

Mr. W. E. Warrilow said the use of two-way and general control switches had an important bearing on the salesmanship of electric light, and, as an electric light user, he protested against its use under purely gas conditions.

Mr. Northwall emphasised the importance of contractors advising the consumer as to the types of fittings, size of lamps, &c., that should be used.

Mr. Bush suggested that at the E.D.A. meetings they should discuss different sorts of lighting installations on different evenings, and not deal with one big subject, such as lighting, generally. For instance, they could devote one evening to home lighting, another to shop lighting, &c., and investigate the subjects more fully. He did not agree with Mr. Harrison as to opalised lamp bulbs. If a filament were too bright why not use an efficient reflector? Also, he did not agree to standardising fittings to the extent America had done.

Mr. Young said that contractors were doing their best under existing conditions, and pointed out that it would be of great assistance if supply companies gave them energy at reasonable rates, to enable them to demonstrate their goods in the proper way, and so increase the sale of electricity. A point of value in selling was to mention the amount of energy used by a lamp per hour, or the number of hours' light obtained from one unit of electricity.

Mr. Sullivan suggested that showrooms should contain two or three models of houses, with the ordinary objects of domestic use arranged in the ordinary way, with suitable fittings in miniature, equipped with electric lamps, giving a proper distribution of light.

Mr. Turle suggested that it might be an advantage to educate people up to a standard illumination before educating them as to electrical fittings.

Mr. Beauchamp stood up for the contractors, and said that, as a body, they were expanding electrically. Co-operation was growing, and that only would enable them to take advantage of expert advice in connection with their advertising. He pointed out the immense advantage of non-technical articles in the Press. He hoped that the conferences to be held next year would be larger, and that by having more meetings they would be able to cut the subjects up into smaller sections, and deal more effectively with each.

Mr. Harrison, replying to the discussion, said he had been misunderstood with regard to standardising. He did not suggest a standard fitting, but that they should, if possible, have a few standard types of fittings, which would give good results. With regard to the expense of installations in small houses, they must make up their minds that eventually those small houses had got to take electric light, and they must adopt every idea they could conceive to hasten that time. He agreed to some extent with the remarks as to individual manufacturers advertising their own particular lamps, because the money spent on advertising had to come from somewhere, and the electrical industry was providing that money. Mr. Simon's suggestion—standardising particular types of illumination—was extraordinarily good. They would then be able to say a reading illumination would be put into one room, a dining illumination in another, and so on. As to showrooms, the houses in which installations were installed should be the showrooms. People visiting those houses would be pleased if the lighting was good, and would immediately want electric light in their own houses.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The "Leader" Cable.

Your interesting note on p. 237 of the Electrical Review, of February 17th, concerning "A French 'Leader' Cable," incidentally directs attention to a coincidence.

The Havre Chamber of Commerce has been studying, with M. Loth, the possibility of laying down an electric "Leader" cable some thirty miles in length. Havre happens, likewise, to have been the first place on French territory between which and a ship out at sea, some fifteen years ago, the present writer's "Two-Tone" inductive telegraphic signalling system was used during the making of a cable-repair final joint and splice on board a ship—in that particular case, 26 nautical miles from the cable-house (cable core, 70 lb. Cu./75 lb. g.p. per n.m.).

This inductive system for maintaining telegraphic communication between ship and shore, along the cable, almost up to the slipping of the final splice, was clearly the forerunner and suggestion-medium from which the "Leader" cable system was derived, which proved so useful at Portsmouth, and elsewhere, during the recent war. Without having before him actual proof, the present writer is convinced that this is so, especially as he has a copy of a report made by him in 1895 to the late Mr. Matthew Hamilton Gray, in connection with Admiralty inquiries. The said report dealt with (*inter alia*) the possibilities attending the use of an electrical "investigator" coil suggested by the writer.

An essential feature both in the writer's inductive signalling system, and in the Admiralty "Leader" system is the *search coil* which, in point of fact, ought always to be known by the name of its inventor, the late Mr. John Gott, formerly superintendent at St. Pierre, N.F., and, for many years before his death, engineer to the Commercial Cable Co.

Gott's fault-searcher was invented primarily for cable-station purposes, *e.g.*, the tracing of wires, local faults, &c., and it will be found described in one of the far-back volumes of the *Journal* of the S.T.E., now I.E.E. Uses pertaining to Gott's useful device were developed by Jona, Kingsford, and Murphy—all, like Gott, telegraph cable men.

Similar coils have long been in use, by electric light companies, for tracing faults under the streets, but whether used for this purpose, or hung over a ship's side while moving through darkness or a dense fog, the coil is John Gott's.

E. Raymond-Barker.

London,
February 20th, 1922.

An Overworked Iron.

We note your correspondent's further letter with reference to the above. He now says there is nothing wonderful in the performance, although he glibly stated in his previous letter that the said result was impossible of achievement and by calculation proved this to his own satisfaction; that his calculation was incorrect as well as his statement does not matter apparently.

Your correspondent made the mistake of assuming that the electric iron overloaded 150 per cent. would be left on circuit continuously even when too hot to use for ironing, knowing full well that it is one of the easiest things imaginable to disconnect an iron from the supply, which could be done at the connector, plug, or switch.

We submit also that it is not fitting for Mr. Scourfield to complain that we are not precise and then to deliberately misquote from our letter. We certainly did not say that an electric iron "is never in use continuously during ironing operations."

Your correspondent says that "if an electric iron is to be switched off every few minutes to prevent overheating and burning of the material, ironing under those conditions would become not only laborious but extremely dangerous." Certainly! but is not the user who puts a 100-volt appliance on a 200-volt circuit "asking for trouble"? Modern irons do not lose their heat in a few minutes. We enclose curves showing the heat-retaining qualities of the "Revo" iron, also the results of interesting tests on one of these irons on double normal voltage. At the risk of a further complaint regarding cheap advertisement, we make bold to say that any interested reader can have copies on request.

P. W. Davis, A.M.I.E.E.,
Engineer.
Cable Accessories Co., Ltd.

Tividale,
February 20th, 1922.

[Abbreviated. This correspondence is now closed.—Eds. Elec. Rev.]

Proposed Emigration—New Zealand.

I notice "Inquirer's" letter in the Electrical Review, of January 27th, which was replied to as regards South Africa, by Mr. C. Crutchley in the Electrical Review of February 3rd, advising him not to go there.

If I had the chance I should go to New Zealand. The climate is nearly exactly like our own. The area of the two islands is about 105,000 square miles (about one-seventh of the size of the British Isles), but the population is only about a million. The total length of the islands is about 1,000 miles, and the maximum width about 180.

Besides farming the country contains coal, gold, iron, tungsten, manganese, and other ores. There is a tremendous amount of water that can be (more easily than most places) tapped for hydro-electric work (the available h.p. is estimated at three and three-quarter millions) without the usual long-distance transmission lines that would have to be run from the average hydro-electric plant to the place where the energy is used. In the North Island, water has already been harnessed and schemes are on foot for further development, for supplying Auckland, Wellington, &c. In the South Island, among others, the districts of Canterbury, Westland, Teviot, Southland, Dunedin, New Plymouth, and Christchurch are supplied hydro-electrically. At Dunedin there is a population of about 64,000 and 6,000 kW of electric plant, and at Christchurch there is a population of 86,000 and 10,000 kW.

Considering its minerals, its water-power, its farming prospects, its fine harbours, its scenery, and especially its beautiful climate, I have long been of the opinion that in time New Zealand will be a rival to the Motherland, as the chief manufacturing centre in the Southern Hemisphere. Those that have the opportunity should get there as soon as they can.

Able finance for development would help New Zealand to make a move that would surprise most of us.

Perhaps if "Inquirer" called at, or wrote to, the office of the High Commissioner, Dominion of New Zealand, 413, Strand, London, W.C.2, he would be informed what prospects of employment there are for a skilled electrical worker, because I should think there would be plenty of openings for such men. If he cared to drop me a line giving his training and experience, I think I could tell him whether he would be useful to an engineer friend who has gone out there.

I know a man who went there, stayed about ten years, afterwards tried Tasmania and Australia, then came back to England, and after those experiences finally returned to New Zealand for good, saying it was the best place of the lot.

Considering the future, especially the children's future, I would go next week if I had the opportunity.

C. T. Allan.

Cardiff,
February 20th, 1922.

The Utilisation of Waste Heat.

As Mr. Dolby's letter in your issue of the 17th instant may lead some of your readers to conclude that a proposition put forward in my letter in your impression of the 3rd instant is impracticable, may I be allowed to point out that Mr. Dolby has somewhat misinterpreted the conditions of working thereby involved.

The proposition that the existing condensing plant of an electrical station should be utilised as part of the heating plant would obviously preclude its use as a vacuum producing apparatus, and would necessitate running the engines or turbines non-condensing or with quite low vacua. It would, as a matter of fact, be impossible to obtain the degree of vacuum alluded to by Mr. Dolby with the hot water circulated for heating purposes passing through the condenser, as contemplated, in place of river or other water.

This particular suggestion was put forward to show that the existing condensing plant of a station could be utilised as part of the heating plant in a combined station, if desired, and in this way save outlay on the heating plant. The question of the resulting reduced output of the electrical plant would require separate consideration.

H. E. Mitchell.

Westminster, S.W.1,
February 18th, 1922.

Electrically-heated Oil Filters.

If your correspondent "Filter" will communicate with me, I think I can give exactly what he requires for this purpose.

The immersed electric element can be supplied with any capacity from 50 to 3,000 watts with either one or three heats, and can be cheaply fitted to existing filters.

I shall be glad to supply full details and prices on hearing from "Filter."

F. C. Geary.

Sheffield,
February 20th, 1922.

The Stiffness of Poles.

Referring to the correspondence on the above subject in your columns, I note that in recommending that the strength in the direction of the line should be one-third of that transverse to the line, Mr. Geo. V. Twiss refers only to the available strength, *i.e.*, the strength additional to that necessary to withstand the wind pressure on the pole itself. This, however, does not affect the principle, as the ratio will still be correct for one set of conditions only.

Whether the wind pressure on the pole can be added to that on the wires depends upon whether we are considering deflection or strength. For finding the former they are not "addable," but for finding the latter—as in the case in point—they are, the load added being, of course, the total wind pressure above the point in the height of the pole which is being considered, equated to the top.

The practical example given by Mr. Chas. W. Kay in your current issue illustrates the effect of varying the span, and shows that the proper ratio of longitudinal to transverse strength is by no means a constant one.

The constructive criticism contained in the latter part of Mr. Twiss's letter is helpful, particularly sub-paragraph 2, which is perhaps the strongest argument that could be advanced in favour of a rational method of design, as distinct from a "straight-line" ratio.

The elasticity of the conductors might have been taken into account in the method I suggested in my article, but as it amounts to only about .0003 of the span for a variation of tension of 5,000 lb. per sq. in., it was neglected.

By a very simple adjustment the method is applicable to severe weather conditions, viz., ice-coated wires subject to wind pressure, and also to conductors of materials other than copper, *e.g.*, aluminium and steel-cored aluminium.

Variations in sizes present no difficulty. The tests should, however, be average tests, because the conditions of equilibrium depend, not upon the deflection of one pole, but upon the summation of the deflections of all poles in the section.

The taking-up of clearances applies equally to the tests and to the poles under working conditions and, similarly, the movement of foundations has its parallel in the tests. These factors, and even the swing of suspension insulators, may all be properly regarded as components of the stiffness modulus.

The whole of these additional factors are, therefore, strictly within the scope of the method I suggest. But if there are those who, while preferring some such rational method to an empirical one, feel that the inclusion of all or any of these factors would involve an unnecessary degree of refinement, it may be said that their exclusion would result in an error of perhaps 50 per cent.—or roughly one-tenth of the error which may result from the use of a constant empirical ratio.

Gower B. R. Pimm, A.M.Inst.C.E.

Westminster, S.W.1,
February 18th, 1922.

The Magnetic Screening of Cables.

Confining my remarks to the case of continuous current, a circuit of any shape or form carrying a constant current is similar to what may be called "a rigidly magnetised body," *i.e.*, to a piece of steel, if such were possible, whose magnetisation is absolutely permanent and unaltered by external magnetising influences. The field of force of such a body can only be altered in the sense of having another field superposed upon it, and such is the case with the constant-current-carrying circuit. In the case of a piece of steel it is not possible to realise this practically, as the inherent magnetisation of the steel is altered by external magnetic influences.

Taking the general case, when a piece of magnetisable matter is placed in the vicinity of a constant-current-carrying circuit, magnetisation is induced and, except in special cases, some free polarity, which free polarity produces its own field of force, which distorts the original field due to the current, by superposition only.

If the shape of the magnetisable matter is such that no free polarity is produced, no distortion of the field can take place; hence, in the simple case considered, with perfect concentricity of cable with iron sheathing, no magnetic screening effect exists. If, on the other hand, the cable is not concentric with the sheathing, some amount of free polarity will be induced in the sheath. (This problem should admit of mathematical solution.) There will, therefore, be some distortion of the external field, but in no case can there be perfect screening.

E. Fowler Clark, B.A., B.Sc., A.M.I.E.E.

Derby.
February 14th, 1922.

Charges for Services.

It appears to the writer that the Electric Lighting Acts in the main features follow the Gas Acts, and for gas undertakers to charge for ordinary supply connections is unheard of.

In the district in which I reside and carry on business, the charges for "connection of premises" in no way follow the spirit of the Act, for preference is shown; for instance, A is charged £10 3s. 5d. for connecting up; B is charged £6 4s. 4d; C £2 19s. 6d.; each of the consumers is well within 20 ft. of mains. A is a daytime consumer of both power and light, and for the sole convenience of the undertakers is called upon to balance both light and power loads so that in addition to having to expend a large extra sum on his wiring he is called upon to pay for additional "Undertakers' safety fuses."

I would say, as regards the premises of A, the undertakers' service lines only just enter the premises and the latter abut on to the street. Shorter service lines would be impossible; B is a private consumer of heat and light; C is a shopkeeper and uses light only.

Another instance of gross robbery: D wires his residence and has to pay £7 for connecting up, part of this being across his garden; his house is sold over his head and he loses his £7 and his wiring, and has to wire his next house and pay for the undertakers' fuses.

Act 62 and 63 Vict., Cap 19, clause 59. "In addition to any meter other apparatus desired by undertakers may be connected but. . . .shall be supplied and maintained entirely at the cost of the undertakers and shall not, except by agreement be placed otherwise than between the mains of the undertakers and the consumers' terminals."

A maximum demand indicator cannot be placed on the street side of the undertakers' safety fuse, consequently the undertakers' safety fuse must remain the property of the undertakers—and such is the general practice.

The expression "consumer's terminals" means the ends of the electric lines situate upon any consumer's premises and

belonging to him, at which the supply of energy is delivered from the service line.

Electricity (Supply) Acts 1882 to 1919; A 24, A 25, A 26, of the regulations for securing the safety of the public lead to the opinion that the safety fuse is the property of the undertakers and should be supplied by them (which in fact is standard practice).

The writer has once taken this matter into Court and has for over two years been awaiting another County Court summons, but the authorities do not seem eager to enforce their rights (?).

The policy of charging for connecting premises is detrimental to the supply authorities, for it leads to a host of would-be electricity consumers remaining gas consumers.

Top Dog.

February 20th, 1922.

This subject certainly calls for illumination, and I hope some of the London supply authorities will bring into the light their methods of charging. To say that each job is "charged on its merits" is mere camouflage—let us have the *system* employed.

A typical case: A lighting service into a cellar on a main road, within a foot or so of the supply mains, was charged up at several pounds.

Another: A projected installation totalling about £30 was overloaded by a service estimate of £14 odd. When challenged, this was reduced to £9. The contractor lost the contract, but the supply company got it. No doubt its gains on the roundabouts enabled the swings to be run a little cheaper.

Again: For several days a supply authority refused to connect a perfectly sound installation fully complying with the I.E.E. rules. When the preliminaries to legal action were taken, it climbed down; but of course an atmosphere prejudicial to the contractor had been established.

In each of these cases the supply authority was also out for installation work. I am told this is a sufficient explanation.

More in Reserve.

February 20th, 1922.

Automatic Telephone Exchanges.

I have read with interest the description of the new Relay automatic telephone exchange, recently installed in the offices of the *Liverpool Courier*. Will you permit me, however, to say that your statement that this is the pioneer newspaper installation is hardly correct in view of the fact that a Siemens Autophone installation was installed in the premises of Odhams Press, Ltd., so far back as October 16th, 1919, and was almost immediately extended to its present capacity of 100 lines. Every department of the printing, publishing, editorial, and advertisement business of our organisation is connected with an unfailing service, for which no too high praise could be expressed.

With regard to the use of the Autophone for connection to Post Office Exchange traffic, I am not sure that this is altogether the boon that it would at first appear. A careful observation of the traffic conditions on our Post Office and Autophone installations shows that in a very appreciable number of instances—more especially in the case of the more important subscribers—the call received from the external source requires a reference to some other internal subscriber, involving the use of the internal system. For that reason it was decided in our case that the saving of the rental of the internal Post Office extensions which would be gained if the Autophones were made to serve the double purpose would be much more than compensated for by the cost of the time wasted by heads of departments, through the absence of a method of dealing readily with our traffic conditions.

Geo. G. Garbett,
Electrical Engineer,
Odhams Press, Ltd.

London,
February 13th, 1922.

[The specially interesting feature of the installation at the offices of the *Liverpool Courier* is that it works through to the public exchange service. In this respect it is unique. —Eds. Elec. Rev.

A Combined Fan and Heater.

In your issue of February 3rd, on the "New Fittings and Devices" page, I noticed that Mr. V. Gillgan, of 50, Bloomfield Avenue, Belfast, had obtained a Provisional Patent for a device which combines an electric fan and a heater. I have myself made experiments in this direction and think there is a big scope for some such device, but on making search I find that such a combination has already been patented by Messrs. Harrison & Peard, on April 24th, 1913. Specification No. 21,854 (of 1912). The first claim is the novelty of a fan and heater in a casing.

If Mr. Gillgan's novelty is also this combination, perhaps it may be news to him that this patent has had all renewal fees paid up to June 15th, 1921.

One experiment I made was with an ordinary portable old lamp stove with a fan fitted in the base and a 2,000-watt heater in place of the lamp. This circulated and heated the air in a small room 14 ft. square much quicker than the oil lamp.

I am only too sorry that my experiments had to come to an end owing to my leaving the house before I could get actual figures as to the air dealt with, time and cost, &c.

L. O. Meyer.

Bedford,
February 14th, 1922.

Co-operative Electricity Supply.

I have read with much interest the article on "Electricity for Country Dwellers," by Mr. J. M. C. Field, in your issue of February 10th. The idea of a co-operative lighting system is certainly a good one, and perhaps Mr. Field has some details of cost at his disposal which would prove of interest.

There is, of course, the difficulty of getting way-leaves for poles, crossing main roads, which are usually under the control of the County Council as apart from rural and urban authorities, and that of obtaining the consent of the Electricity Commissioners, which would have to be overcome.

At the moment I am concerned with the installation of a private power plant, overhead line, &c., for supplying two factories owned by one company in a small Somersetshire town, and although the townspeople are interested in electricity the cost has proved a stumbling block up to the present. Perhaps you will afford Mr. Field some more of your valuable space to elaborate his ideas.

Harry J. Leeves-Johnson, A.I.T.E.

London,
February 15th, 1922.

[Local authorities, including County Councils, have no power to prevent the crossing of a road with overhead lines unless they own the road, which is seldom the case.—Eds. Elec. Rev.]

The Fetish of the Quick-make and Quick-break Switch.

From a perusal of the advertisement pages of your valuable journal it would appear that switchgear manufacturers have again found it necessary for users of electrical switchgear to install quick-make and quick-break switches of various capacities.

Switches are now being offered for sale from the tumbler switch size to large ironclad switches, all of which seem to base their action on the principle of the "toggle joint," which gives a quick action on either side of the dead centre.

It would appear that manufacturers originally adopted this mechanism for the purpose of obtaining a quick break, and finding that a quick-break action also gives a quick make by slight modification, they have insisted upon the advisability of quick-make switches.

Quick-make and quick-break switches using the toggle action have been on the market for some 15 to 20 years, and have also been used down to small capacities, such as five amperes. A reference to the Patent Office files will reveal hundreds of applications of this mechanism as applied to large and small switchgear. In the application of a quick-make and quick-break switch, more particularly to the smaller sizes, what the manufacturer actually does in supplying a switch of this kind is to remove the human element in switching-on and replace it by a small spiral spring, which cannot give anything like the pressure necessary in switching-on and closing the blades of the switch into stiff springy contacts, a weakness in all quick-make switches being that the pressure exerted by the contacts on the blade of the switch must be exceedingly light and necessarily weak, to enable the small spring as used in the toggle mechanism to rapidly withdraw the contacts when breaking, and rapidly insert the contacts when making. It will be obvious from a little consideration that if the contacts are comparatively stiff the spring will not enable the switch to make and break the circuit.

The advantage of the old type of slow make in large and small switches is that the operator in closing the switch by hand exerts a considerable leverage and thereby closes the switch blades into strong and substantial contacts which have a first-class bearing surface and are not, therefore, liable to over-heating, sparking, &c.

It is always interesting to examine a few of the millions of tumbler switches, which have been used in many instances for years and years, having a slow make, and to see what little damage, if any, has been caused to the contacts by this so-called defect. The natural tendency on either the tumbler switch or the enclosed knife switch is to push the lever the maximum range of its stroke. There is no inclination or desire by the operator to half-close the switch. In fact, it is difficult for him to know when a switch is partially closed if the switch is protected by a cover. In the thousands of switches—large and small—installed all over the country, the writer is of the opinion that very little (if any) damage has been due to the switches not being provided with the necessary so-called quick make. Anyone can appreciate the necessity of a quick break. We are told by some manufacturers that owing to the advent of the gasfilled metal-filament lamp quick-make switches are necessary, although the writer has a bank of three 100-watt lamps in his office controlled by a

very old-fashioned tumbler switch which has not shown any signs of distress even when the circuit is repeatedly made very slowly. Slow-make tumbler switches can be found that have been in continual use for very long periods, and show little or no wear, either mechanical or electrical.

Perhaps some of your readers will be able to give a little further information on the necessity for quick-make switches.

London, C. W. Denny, A.M.I.E.E.
February 13th, 1922.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Flame-proof Junction Boxes.

For use with wire-armoured v.i.r. cables for lighting in fiery mines, explosive factories, and similar situations, junction boxes of special flame-proof construction are required, but it has always been found difficult to meet all the varied demands of service. A range of flame-proof lighting boxes has recently been developed by the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, in which it has been found possible, by the use of only three standard forms of box and three types of glands, to cater, it is claimed, for practically every lighting requirement in danger areas. The boxes, of which we reproduce typical examples (figs. 1 and 2), are of robust construction, and comply with the regulations laid down in the Coal Mines Act. Among the features

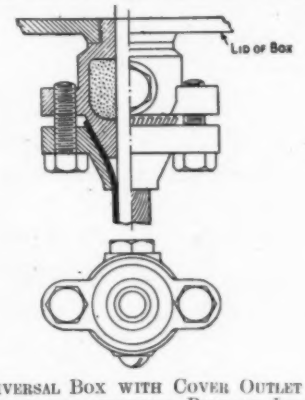


Fig. 1.—Universal Box with Cover Outlet Fitted with Gland for attaching Pendant Light.

embodied in their design may be mentioned machined flanges of generous width on both box and cover, a simple locking device, and special attention to insulation. The arrangements for securing the cable armouring and for protecting the cable up to the point where the armouring leaves it can be seen from the drawing (fig. 1). The armouring is clamped between two concentric cones, giving a large contact area and ensuring a firm connection and perfect continuity.

The "Universal" junction box (fig. 3) can be supplied as a one, two, three, or four-way box with any one of three types of cover: (*a*) a solid front with central outlet tapped

Fig. 2.—Gland with Sealing Chamber.

½ in. gas and plugged; (*b*) a cover for attaching a well glass fitting; and (*c*) a cover for attaching a bulkhead fitting. The solid front is supplied where the box is required merely as a junction box, or where pendant lights are required. In the latter event either a conduit drop with a well glass fitting or a cable gland with a sealing chamber (fig. 1) can be fitted. Two types of glands can be supplied, one forming an integral part of the box and the other detachable; the latter type can be removed, together with the sealing chamber, by removing two bolts. In this manner connections or complete branch circuits can be prepared above ground and attached to boxes already erected, and renewals and repairs can be effected conveniently. The third type of box is a split junction box for use with the mining-type lighting boxes when running cables are employed. By the use of split glands the cable may be tapped at any point and the branch circuit, which can be made up complete, attached with the minimum interference with working.

The "Wyeco" Cable Suspender.

The West Yorks. Electrical Co., Ltd., 22, Cross Hills, Halifax, sends us particulars of a new type of cable suspender for which it has secured a provisional patent. It is made in two sizes, the larger of which is shown in fig. 3. As will be seen from the illustration, the suspender, which is of zinc or other metal, is bent round and the end is retained in position

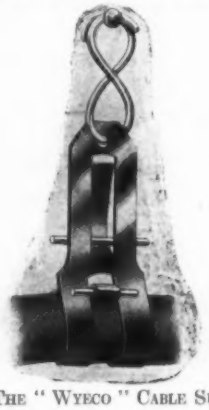


Fig. 3.—The "Wyeco" Cable Suspender.

by a shearing pin; a spare pin is fitted in a spring clip. The smaller size is similar in style, but an impregnated tape loop is used to bind the cable and a metal end, similar to that of the larger size, is fixed to the end of the tape, and when in position is similarly kept in place by a shearing pin.

The "C. P." Universal Welder.

We have received particulars of a very useful and adaptable electric welding machine made by the Consolidated Pneumatic Tool Co., Ltd., Egyptian House, 170, Piccadilly, W.1. This is the "C.P." "Universal" welder, upon which seam, butt, or spot welding may be carried out. The outfit consists of a transformer, with a regulation switch for adjusting the temperature to suit the work being executed; an operating pedal for bringing the electrodes together; a quick-break switch; double-pole fuses; and sets of special water-

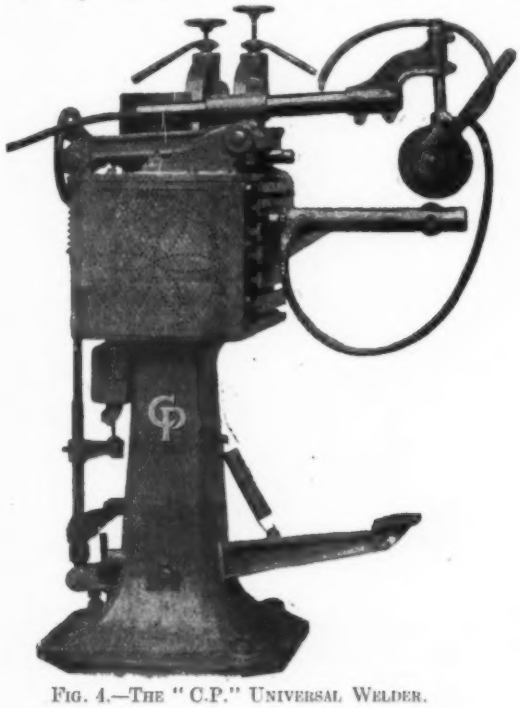


Fig. 4.—The "C.P." Universal Welder.

jacketed electrode-holders. The illustration (fig. 4) shows the machine fitted up for seam welding. It will be seen that the lower electrode holder is bolted to a slotted face-plate, while the other fits into a holder at the top of the machine. The conversion of the machine for butt or spot welding is a simple operation, involving merely the changing of the electrode holders. These welders are made in a number of sizes, ranging from 9 to 25 kW for 40- or 60-cycle supplies.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

2,990. "Safety devices for winding or hoisting apparatus." Metropolitan-Vickers Electrical Co., Ltd., and C. E. Raeburn. February 1st.
2,991. "Control handles for electric devices." R. Brooks (Westinghouse Electric and Manufacturing Co., partly) and Metropolitan-Vickers Electrical Co., Ltd. February 1st.
2,992. "Selecting switch mechanism." G. Deakin and Western Electric Co., Ltd. February 1st.
2,997. "Electric regulating switches." F. C. Curtis. February 1st.
3,009. "Sealing ends of electric cables." P. Dunsheath and W. T. Henley's Telegraph Works Co., Ltd. February 1st.
3,013. "Leading-in wires for electric incandescent lamps, &c." P. Bornkessel and H. Lahr. February 1st. (Germany, February 2nd, 1921.)
3,025. "Wireless receiving systems and apparatus." L. S. Palmer and L. G. Preston. February 1st.
3,033. "Antennæ systems for wireless communication." E. Y. Robinson. February 2nd.
3,034. "Vacuum tubes." E. Y. Robinson. February 2nd.
3,072. "System of seat indication in theatres, &c." G. Finestone and R. E. Jones. February 2nd.
3,080. "Impulse senders for automatic telephone systems." J. Berry, D. A. Christian, and Siemens Bros. & Co., Ltd. February 2nd.
3,081. "Electricity supply systems." Siemens Bros. & Co., Ltd., and H. G. Wood. February 2nd.
3,102. "Oil circuit breakers." British Thomson-Houston Co., Ltd., and H. Trencham. February 2nd.
3,103. "Telephone systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). February 2nd.
3,110. "Electric water heaters." C. Kratt. February 2nd.
3,116. "Means for securing shades to holders of electric lamps." H. F. Wheeler. February 2nd.
3,117. "Heat-deflecting device for electrical rheostats, &c." E. Swainson and Thermal Electric Works (Hackbridge), Ltd. February 2nd.
3,126. "Electrical and mechanical connections or joints." British Electric Transformer Co., Ltd., and S. C. Mount. February 2nd.
3,129. "Telephone systems." Siemens & Halske Akt. Ges. February 2nd. (Germany, February 19th, 1921.)
3,134. "Magnetos." F. L. Hollister and C. A. Vandervell & Co., Ltd. February 2nd.
3,196. "Sparking-plug for internal-combustion engines." W. H. Shute. February 3rd.
3,201. "Telephone and signalling systems on electrical transmission lines." Callender's Cable & Construction Co., Ltd., and C. W. Kay. February 3rd.
3,210. "Insulators for electrical transmission lines." Callender's Cable and Construction Co., Ltd., and A. E. Wilson. February 3rd.
3,219. "Electromagnetic relays." British L.M. Ericsson Manufacturing Co., Ltd., and W. M. Crowe. February 3rd.
3,221. "Wireless reception apparatus." G. Castagnoli. February 3rd.
3,228. "Voltaic cells." A. de G. Spino. February 3rd.
3,232. "Means for laying and picking up submarine cables, &c." F. E. Perrnot. February 3rd.
3,233. "Electric switches." S. Davies. February 3rd.
3,240. "Preserving electric motors from prejudicious surrounding medium." R. Longue. February 3rd.
3,249. "Sparking plugs." L. Wells. February 3rd.
3,250. "Machines for marking telegraph forms or receipts therefor." L. Avery. February 3rd.
3,256. "Telephone station equipped with telephonograph." Naamlooze Vennootschap Financiecle Maatschappij Driebergen. February 3rd. (Germany, February 7th, 1921.)
3,258. "Electro-magnetic clutches." J. W. Hall. February 3rd.
3,264. "Electric fuses." W. Clark. February 3rd.
3,265. "Game apparatus." W. Clark. February 3rd.
3,266. "Electric switches." W. Clark. February 3rd.
3,267. "Means for amplifying intensity of sounds." J. Levy. February 3rd.
3,268. "Adjustable supporting-bracket for electric, &c., lamps." W. Grafton & Sons, Ltd., and W. P. Grafton. February 3rd.
3,270. "Apparatus for charging accumulators." H. G. H. de G. d'Avenas. February 3rd. (France, February 15th, 1921.)
3,273. "Electrical generating machines." H. F. Joel and T. W. Simpson. February 3rd.
3,280. "Electric motors." Lancashire Dynamo & Motor Co., Ltd., and R. S. McLeod. February 4th.
3,281. "Supporting electric cables, &c." L. M. Waterhouse. February 4th.
3,285. "Electric fittings." H. V. Cornish. February 4th.
3,286. "Coil or winding for electric apparatus." H. J. Brearey. February 4th.
3,301. "Mechanical signalling device." F. Croft. February 4th.
3,326. "Electrical vehicles." L. C. Guyer. February 4th.
3,327. "Electric foot-warmers and heaters." R. K. Robertson, T. Scott, and Scott & Robertson. February 4th.
3,332. "Indicating instruments." British Thomson-Houston Co., Ltd. February 4th.
3,333. "Determining distances by means of reflected sound waves." H. Baron (Signal Ges.). February 4th.
3,345. "Signalling systems." Radio Communication Co., Ltd., and J. Ree. February 4th.
3,347. "Electron discharge apparatus." O. Durdle, General Electric Co., Ltd., and C. F. Trippe. February 4th.
3,349. "Wireless receiving apparatus." J. H. Reeves. February 4th.
3,363. "Negative electrodes for batteries, &c." E. E. G. Boite and W. H. Edridge. February 4th.
3,364. "Fitting for incandescent gas light or electric light." H. J. Adams. February 6th.
3,377. "Vacuum tube for receiving and transmitting continuous wave oscillations in wireless working." C. S. Goode. February 6th.
3,378. "Induction coil or transformer for transmission of speech." J. Simpson. February 6th.
3,398. "Sparking plugs." E. S. Brown and G. E. Stubbs. February 6th.
3,413. "Manufacture of electric cables." Callender's Cable & Construction Co., Ltd., and P. V. Hunter. February 6th.
3,416. "Method of mechanically recording and checking telephonic calls of different values." T. H. Green and N. C. Headland. February 6th.
3,420. "Magneto brush rotor." P. W. Corless. February 6th.
3,423. "Glands of electric joint boxes." C. J. Beaver and E. A. Claremont. February 6th.
3,432. "Electric lighting apparatus for motor-cars, &c." A. C. Lock and S Smith & Sons (Motor Accessories), Ltd. February 6th.
3,433. "Ignition apparatus for internal-combustion engines." A. C. Lock and S. Smith & Sons (Motor Accessories), Ltd. February 6th.
3,436. "Means for translating vibrations." Signal Ges. February 6th. (Germany, March 7th, 1921.)
3,446. "Radio receiving systems." H. J. Round and G. M. Wright. February 6th.
3,449. "Indicators for ships' electric signal, &c., lamps." T. Harrison. February 6th.
3,452. "Electric storage batteries." H. G. Wagner. February 6th.
3,453. "Manufacture of positive and negative elements for electric storage batteries." H. G. Wagner. February 6th.
3,457. "Interrupters for electric circuits." Metropolitan-Vickers Electrical Co., Ltd. February 6th. (United States, April 25th, 1921.)
3,459. "Protective arrangements of electric generating, transmission, and distribution systems." Ferranti, Ltd., and A. H. Higgs. February 6th.
3,460. "Protective means for electric switchgear." Ferranti, Ltd., and A. H. Higgs. February 6th.
3,461. "Protective means for electric switchgear." Ferranti, Ltd., and A. H. Higgs. February 6th.
3,466. "Method of indicating and recording load on weighing-machines and dynamometers." H. S. Hele-Shaw. February 6th.
3,482. "Systems of generation of high-frequency currents." E. Y. Robinson. February 7th.
3,521. "Telephone signal device." T. McKenna (Dictograph Products Corporation). February 7th.
3,522. "Signal systems for telephones." T. McKenna (Dictograph Products Corporation). February 7th.
3,523. "Sectional switchboard frame." T. McKenna (Dictograph Products Corporation). February 7th.
3,524. "Battery carrier and connector." T. McKenna (Dictograph Products Corporation). February 7th.
3,529. "Electric switch mechanism." E. N. Bray and Electrical Apparatus Co., Ltd. February 7th.
3,532. "Process for cleaning inside of electric lamp bulb." W. J. Webb. February 7th.
3,534. "Inductance coils for currents at radio-frequency." W. R. H. Tingey. February 7th.
3,553. "Telephone call distribution system." G. Deakin and Western Electric Co., Ltd. February 7th.
3,554. "Telephone exchange systems." Western Electric Co., Ltd. (Western Electric Co., Incorp.). February 7th.
3,555. "Storage battery grid." C. E. Funnell, A. O. Garratt and W. L. Hoffman. February 7th.
3,561. "Sparking plugs." R. Haddan (Corning Glass Works). February 7th.
3,575. "Apparatus for electric heating of engines of the hot-bulb type before starting." T. G. Grundey, G. B. Petter and Petters, Ltd. February 7th.
3,594. "Anodes for mercury-vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. February 7th. (Switzerland, February 18th, 1921.)
3,611. "Single-phase induction motors." F. H. Robinson. February 7th.
3,612. "Single-phase induction motors." F. H. Robinson. February 7th.
3,616. "Electrically-heated hair-waving appliances." G. Boudou. February 7th.
3,630. "Electric accumulators." L. Martingnoni. February 7th.
3,645. "Wireless telegraph receivers." L. B. Turner. February 8th.
3,653. "Rotary contact devices for electric ignition in internal-combustion engines." S. George (J. H. George). February 8th.
3,682. "Sparking plugs." E. Martin. February 8th.
3,689. "Wireless call device." H. Merriman, H. R. Rivers-Moore and R. M. Radio, Ltd. February 8th.
3,695. "Electrical toasting or heating apparatus," Phi-Kappa Syndicate, Ltd., and D. Watson. February 8th.
3,697. "Glow-discharge lamps." Naamlooze Vennootschap Phillips' Gloeilampenfabrieken. February 8th. (Holland, February 9th, 1921.)
3,698. "Gas-filled discharge tubes." Naamlooze Vennootschap Phillips' Gloeilampenfabrieken. February 8th. (Holland, February 9th, 1921.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

20,930. "Vacuum-tube oscillation generators for wireless signalling." Dr. E. F. Huth Ges. and B. Rosenbaum. September 27th, 1917. (149,191.)
20,959. "Receiving arrangement for wireless telegraphy." W. E. Evans (Dr. E. F. Huth Ges.). July 12th, 1920. (Convention date not granted.) (149,212.)
20,992. "Apparatus for the wireless transmission of messages." Dr. S. Loewe. October 26th, 1918. (151,968.)
20,997. "Arrangement for receiving electric oscillations with several receiving tubes." W. E. Evans (Dr. E. F. Huth Ges.). July 12th, 1920. (Convention date not granted.) (149,239.)
23,529. "Temperature-controlled apparatus for electric irons for preventing their overheating." T. Klotzli and Sohn. August 11th, 1919. (150,310.)
29,034. "Electric switches." Cable Accessories Co., Ltd., F. H. Reeves and A. Crawford. October 14th, 1920. (174,406.)
29,044. "Portable miners' electric lamps." E. A. Hailwood. October 14th 1920. (174,407.)
29,049. "Electric switch for use more especially in connection with electric-lighting sets of motor and other cycles." Efandem Co., Ltd., and J. Eaton. October 14th, 1920. (174,408.)
29,929. "Radiogoniometry." H. Abraham and M. Philippson. October 22nd, 1920. (174,429.)
30,257. "Devices for determining intervals of time." British Thomson-Houston Co., Ltd. (General Electric Co.). October 26th, 1920. (174,441.)
31,809. "Current transformers for protective systems for electric apparatus." British Thomson-Houston Co., Ltd., and H. S. Holbrook. November 10th, 1920. (174,475.)
31,936. "Frames for electro-magnetic clocks." M. P. Favre-Bulle. November 11th, 1920. (174,478.)
32,066. "Electric switches." O. Oldham, G. Oldham and J. Oldham. November 12th, 1920. (174,480.)
32,809. "Miners' electric safety lamps." A. P. Ford. November 20th, 1920. (174,487.)
33,515. "Electric lamp and switch-holder." A. P. Rutherford and A. N. Haddow. November 27th, 1920. (174,500.)
34,250. "Electric resistance controllers." Wisconsin Electric Co. October 25th, 1915. (154,309.)
34,883. "Mercury electric lamp." R. L. M. Belleaud and J. Barrollie. August 14th, 1920. (168,022.)
35,438. "Safety controlling gear for electrically-propelled vehicles." R. Garratt & Sons, Ltd., and A. J. Serve. December 16th, 1920. (174,512.)
36,368. "Mercury-vapour rectifiers." J. Nienhold. February 14th, 1920. (159,170.)

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2,653. "Make-and-break devices for induction coils and the like." M. A. Codd. January 20th, 1921. (174,523.)
2,677. "Ignition magnetos for internal-combustion engines." H. Lucas and H. W. F. Ireland. January 20th, 1921. (174,524.)
2,678. "Electric lamps for vehicles." H. Lucas and W. H. Egginton. January 20th, 1921. (174,525.)
4,858. "Process and apparatus for making electrodes and abrasives." W. G. Michel. February 11th, 1921. (174,529.)
5,754. "Casings for electric pocket lamps." B. Rogge. March 24th, 1920. (160,761.)
8,375. "Apparatus for suppressing the higher harmonics in metal-vapour rectifiers fed through polyphase choking coils." Akt. Ges. Brown, Boveri et Cie. March 27th, 1920. (160,782.)
9,910. "Apparatus for suppressing upper harmonic currents in metal-vapour rectifiers fed through polyphase transformers." Akt. Ges. Brown, Boveri et Cie. April 10th, 1920. (161,519.)
31,438. "Electric emergency lighting installations." P. Das. October 28th, 1920. (Addition to 162,587.) (170,825.)